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INDEX TO VOL. X.

THE ARTIZAN JOURNAL, 1852.

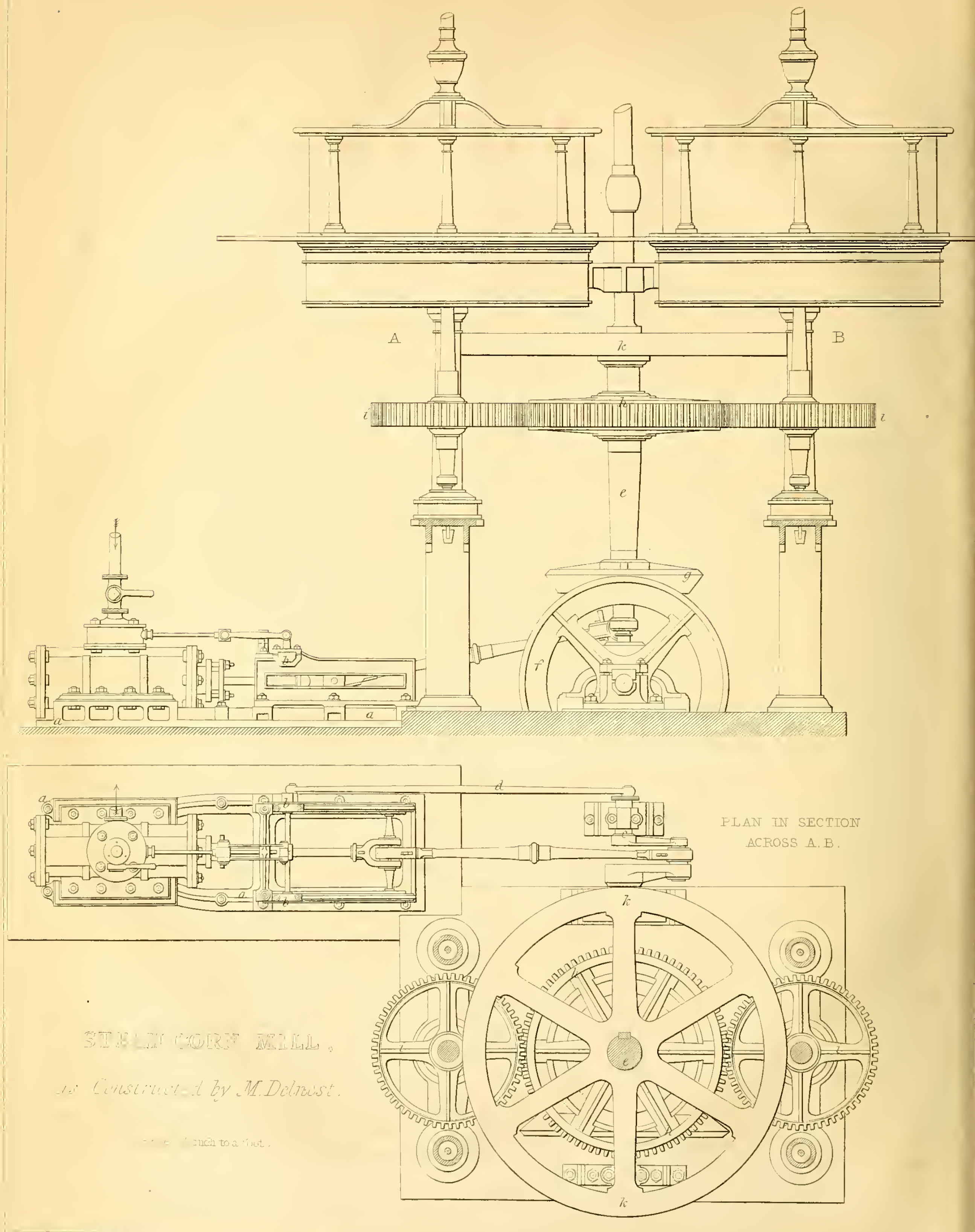
LIST OF PLATES.

DIRECTIONS TO THE BINDER.

Plate 12 to form the Frontispiece. The remaining Plates to be placed at the end of the Volume.

LIST OF 235 ILLUSTRATIONS ON WOOD, IN THE PRESENT VOLUME.

THE FOLLOWING ENGRAVINGS ACCOMPANY THE PLATES BELONGING TO THE SERIES OF ARTICLES ON COTTON AND ITS MANUFACTURING MECHANISM.



STEAM CORN MILL,

as Constructed by M. Delmest.

THE ARTIZAN.

No. I.—Vol. X.—JANUARY 1st, 1852.

THE SMOKE QUESTION.

(Continued from Vol. IX., page 266.)

PLANS DEPENDING ON THE ADMISSION OF AIR TO THE FURNACE.

We have already shown, that a supply of air, proportionate to the quantity of coal consumed, is absolutely necessary to allow perfect combustion to take place.

This truth is so obvious, that it has been seized upon by a numerous host of inventors, who, acting upon the principle that one cannot have too much of a good thing, have expended a vast amount of ingenuity in devising schemes for the admission of air in every possible way. A mere list of these plans would occupy more space than we could spare; they may, however, be summed up very briefly, by describing one particular method which has met with more patronage than the rest. The plan alluded to is that known as Mr. Charles Wye Williams' "Argand" furnace. An "Argand" lamp, as all our readers know, is one in which air is admitted through the flame, and, inasmuch as all close furnaces are supplied with air through the bars, they are as much entitled to be called Argand furnaces as Mr. Williams', in which an additional supply of air is admitted through a row of perforated pipes, at the back of the fire. The quantity of air admitted through these pipes is governed by a valve, which can be adjusted at pleasure by the fireman.

There are two radical evils attending this plan, when hand-firing is employed.

First,—the supply of air is regular, whilst the demand for it is irregular.

Hence, if the supply be so adjusted as to give sufficient air when the charge of coal is first thrown on, it will be in excess when the charge is partially worked off, and the air will then only have the effect of cooling the boiler and flues.

Secondly,—the alternate heating and cooling of the boiler bottom, just above the air-pipes, expands and contracts the plates of iron of which it is composed, and makes the boiler leaky; the cost of a single repair, in this case, probably swallowing up the whole sum saved in fuel in a twelvemonth.

All the plans that we have ever heard of, in which these difficulties were sought to be overcome by an adjustment of the supply of air by the fireman at every charge, have failed, simply for the reason that it is too much trouble, and requires a degree of constant watchfulness and attention which may be expected by inventors, but which we have never been able to find in any man who would accept fireman's wages.

Of the numerous plans which have been tried, depending on the admission of heated air in various ways, we need say little. Their increased complexity and first cost, without affording any superiority over the plan just described, are alone sufficient to prevent their adoption.

Still, an additional supply of air has such a beneficial effect in mitigating the production of opaque smoke, that we anticipate that this plan will be resorted to by many, who will be blinded to its defects by the simplicity of its application.

Another plan may be mentioned here, as it occupies a position midway between the plans mentioned in this chapter, and in the next—That is

Chanter's Patent Moveable Fire-bar Furnace.—In this arrangement, the alternate bars are simultaneously lifted by a lever, in order to free the bars from clinkers; and so far we believe it to be effectual, and for the same reason it will diminish the production of smoke by allowing a freer passage for the air, and possibly effect a small saving of fuel. But the bars being only moved a few times, just before firing, this plan is quite inadequate to entirely prevent the production of smoke, and the labour of the fireman is not in any way diminished.

ON FIRING BY MACHINE.

It is by machine-firing alone that we can obtain *perfect regularity* of combustion, which we have shown to be the most effectual means of preventing the production of smoke.

The systems of firing by machine may be divided into two classes; one consisting of those in which the coal is thrown on to an ordinary furnace by the machine; and the other of those in which the fire-bars themselves move, and draw on the coal.

An economy attends the use of firing machines, not only because less coal is consumed, but because the small coal, at a much less price per ton, is equally available with the large coal. Machines of the first class, it is true, are not perfect smoke-consumers, as ordinarily constructed; but an improvement has lately been introduced which promises to overcome the difficulty, and render them equal to the second class.

These machines were some time since in rather extensive use in the manufacturing districts, but are now out of fashion, not, as we believe, from any special defect, but simply because their repair gave some slight trouble.

Their construction may be briefly described. In front of the furnace, and at a slight elevation above the bars, is a metal disc, having a vertical spindle, set in rapid motion by a strap driven from the engine. The disc is enclosed in a case, and is supplied with coal from a hopper above, by means of two pairs of rollers, placed one pair above the other, and driven from the upright spindle. The coal is thrown into the hopper, and is crushed by the rollers to an uniform size. It then falls on the revolving disc, an arm upon which strikes it, and throws it on the fire. The supply of coal is thus uniform, and can be adjusted to the exact quantity required. The defect to which we have before alluded lies in the tendency of the machine to throw the coal on *one* side of the fire, where it accumulates, whilst on the other side the fire burns thin. When the fire is stoked to level it over the bars, the disturbance of the body of coal never fails to produce a volume of smoke.

This is ingeniously obviated in a recent patent, in the following manner. By a self-acting arrangement, the disc is made to reverse its motion (or it may be done by hand), so as to supply each side of the furnace alternately; and thus the accumulation of coal has time to burn away.

Moveable Furnace Bars have been applied in a variety of ways. That known as Juckes' patent is ingenious and effective. Candor compels us to add, that it is expensive, complicated, and very liable to derangement. In this plan the furnace bars are entirely detached from the boiler, or the brick-work in which it is fixed. They are short in length, and are linked together, forming an endless chain, which is supported by a roller at each end of the fire. The coal is thrown into a hopper in front of the fire, and a slow motion having been given to the bars by the engine, the coal is gradually drawn through an adjustable orifice, and consumed during its passage to the back of the furnace, where the clinkers are received in a space left for the purpose.

The disadvantages of this plan are its heavy first cost—its bulk, which renders it difficult of application to boilers with internal furnaces—and its liability to derangement, and the consequent cost of repairs. Cases have occurred where the points of the bars have caught in the brick-lining of the furnace, and have both disturbed the brick-work and broken the machinery. When the number of pins and joints, on which the bars move, are considered, and how rapidly the presence of heat and grit tends to hasten the wear on them, it is no wonder that they should require constant renewal.

A plan, preserving the principal merits of Juckes', with less complication, is—

Hall's Patent Moveable Fire-bar Furnace, which has been found a very effectual smoke burner. In this arrangement, each fire-bar has an independent reciprocating longitudinal motion imparted to it by an eccentric, of which there are a series on a revolving shaft fixed in front of the furnace, and moved by the engine. At the front end of each bar are three or more toothed projections, which, when the bar moves towards the boiler, push forward a small quantity of coal, which has fallen on them during the backward movement, from a hopper over the bars. The coal is coked in front of the furnace, and then gradually carried, as described, to the back of the furnace, where the clinkers, if any are formed, fall into a recess left for the purpose, whence they are periodically removed. Air is admitted through orifices between the hopper and the front of the boiler, and the bars are kept perfectly free from clinker by the motion in opposite directions of those adjacent to each other. These circumstances, coupled with the fact that the fire-doors never require to be opened, seem to fulfil all the conditions which the economy of combustion demands, yet, strange to say, we have been informed that they have been found slightly less economical than hand-firing, in cases where existing boilers have had their furnaces altered. Better skill in proportioning them, and adapting them to varying circumstances, would most probably convert this loss into a gain. We could more readily understand that the wear of the eccentrics and bars would be objected to, although repairs would be executed with greater facility and economy than in the case of Juckes' endless chain of fire-bars. Another still simpler plan is—

Godson's Patent Furnace.—This acts upon the principle of feeding the fire at intervals, from below—the smoke arising from the irregularity of the supply of fuel being consumed in passing upwards through the red hot coal. In the centre of the fire-grate a vacancy is left, which can be closed at pleasure by sliding shutters, beneath which is a cast-iron box, which is provided with a piston, moved through the intervention of racks, pinions, and levers, by the fire-man. The fire is fed in the following way:—suppose the shutters closed—the piston is depressed to the bottom of the box, a door in front of which is opened, and admits the coal, with which the box is then filled. The door being closed, the shutters are opened, and the piston is then raised at intervals, until the box is emptied, when the operation of filling is again repeated. Although this plan is not such a perfect smoke-consumer as Hall's or Juckes', its lower cost, and the probability of its working for some years without repairs, seem to render it worthy of favourable consideration. It gives more trouble to the fireman than either of the other two plans; but it is fair to add, that all these plans of machine-firing would offer a still greater economy in wages, as compared with hand-firing, in those cases where a number of furnaces are employed, and on the former systems, all attended by one fireman, whose duty is merely to fill the coal hoppers.

Boulton and Watt's revolving Grate, as used at the Bank of England, is ingenious and effective. The fire-grate is of a circular form, placed in front of the ordinary boiler, and covered by a small supplementary boiler of a peculiar shape, on the bottom of which the flame first acts, and thence passes through the ordinary flues. The grate is made to revolve slowly by being connected with the engine, and is supplied with coal from a hopper placed above the supplementary boiler before mentioned. This arrangement is as efficient, and less complicated than Juckes'; and would be more economical in first cost, could the supplementary boiler be dispensed with, which it does not appear there would be any great difficulty in doing.

(To be continued).

THE IRISH DIFFICULTY, AND ITS SOLUTION.*

IRELAND has so long been an enigma to legislators and economists, that we can easily understand why the last phase in her history, the "Celtic Exodus," has been received in England with so much apathy. It is impossible to realize to oneself the feeling with which such a movement, were it to take place in this country, would be received. To be told that a stream of 1,000 souls per day is pouring forth from the sister country, conveys to us but a very inadequate idea of the effect in every-day life of such a system of depopulation. Let the reader who dwells in a village of some one or two thousand inhabitants, and whose business is confined to that village, picture to himself the effect which would be produced by the loss every week of but half a dozen individuals out of that limited society. The very thought would make the landlord as well as the tradesman turn pale; and yet we cannot doubt that this change is daily taking place in Ireland, either for weal or for woe, according as we embrace, or throw away, the opportunity which Providence has now afforded us, of planting the Saxon race where the Celt has faded away. A concurrence of events seems to point out that the time for accomplishing this change has now arrived. The depopulation of whole districts in Ireland—the amount of land of good quality to be obtained at a moderate price and with unassailable titles—the difficulty under which tenant farmers in England will labour, until rents have found their own level—and the increase of population on this side of the channel, all unite in rendering such an equalization of population, not only desirable, but absolutely necessary.

The difficulty consists in providing adequate inducements to emigrate, for the English or Scotch farmer who has capital at his command. If his capital be disengaged, he is more likely to lay it out in establishing manufacturing operations of some kind, which promise him a larger return than purely agricultural pursuits, and in his own locality, where his connexion and reputation may best serve him. The agriculturist wants not only cheap land, but he wants a good market; a truism which has proved fatal to numerous schemes which, on paper, appeared perfectly unimpeachable. This market then has to be made, or, in other words, consumers have to be provided to remove the risk of loss; and this requires, first, a sufficient population, and some remunerative

* *How to Employ Capital in Western Ireland*, by W. D. Seymour. London, Hearne. *The Flax Movement*, by the Chevalier Claussen. London, Effingham Wilson.

manufacturing pursuit on which to employ that population. It is obvious that, in the sense here meant, a slate quarry or a copper mine manufacturing pursuit. The food-producer and the food-consumer stand in mutual need of each other, and the problem is, to bring them together on a scale of sufficient magnitude to render the experiment successful. We say a scale of sufficient magnitude, for we have in our mind's eye a number of cases, in which individual patriotic exertion, in establishing manufactories, has but brought ruin on the projector; and the only consolation of the self-sacrificed landowner has been, that success was deserved, though it could not be commanded. Had that great statesman, Sir Robert Peel, been spared to the nation, we should, doubtless, ere this, have had the opportunity of illustrating our theory with the results of practical experience. The plan which the master-mind originated, we trust to see carried out by those who will make up in number what may be wanting in individual influence. It is only by united and systematic action that success can be insured. Our aim must be to transplant a whole English county, entire, into the West of Ireland, there to leaven the whole mass. If we cannot move an entire county, let us begin with a parish. "Very good," the reader may say, "but who is to find the money?" Show a reasonable prospect of a 5 per cent. dividend and good security, and you could raise capital to convert the Great Wall of China into a railway, much less to move a few thousand persons across the Irish Channel. "But can this dividend be shown?" We think it can, and we will state a few facts to support our belief. Land of first-rate quality, well situated for water or land carriage, can be purchased in the West of Ireland, at about one-half the cost of similar land in England. This land, purchased in the gross, could be divided, and let on lease, so as to produce 5 per cent., after paying all expenses of management. There is only one thing wanting. It is easy to get tenants, but it is not so easy to get tenants with capital. How can they be attracted and secured? *By giving them the option of purchase whenever they are in a position to lay down the money.* By this arrangement a given amount of capital would go much further, and a tenant would not impoverish himself by becoming at once the owner of the soil, but would employ his capital in draining, manuring, and machinery. A lease under fair covenants, and a certain prospect of becoming in a few years his own landlord, would attract a superior class of tenants, and afford them the strongest possible incentives to industry and love of order.

We have in previous articles pointed out what may be done to save capital by concentrating farm buildings and machinery. *Concentration of machinery is the soul of cheap production.* Witness our cotton mills and machine shops.

Having provided our farmers, our next care must be to supply them with occupation and a market. The climate of the West of Ireland, described by her national poet as "half sunshine, half tears," is too uniformly moist to grow wheat crops in perfection; but for the same reason it is better suited for green or bulbous crops. Of these we shall consider but two, for our present purpose—Flax and Beet.

First, as to Flax. We confess that on this subject we have read a great deal, and have been convinced of very little. Flax is pronounced by every body with a most wonderful unanimity, to be the most profitable crop a farm is capable of producing, but—some-how nobody cultivates it—they are afraid of getting rich too fast, that seems the only solution of the difficulty. We will state the reasons they give us, and leave our readers to decide the question. First, it is said "Flax is a very exhausting crop."—What says Chevalier Claussen:—

The opinion is one which has been handed down almost from time immemorial, and the clauses which in many cases are introduced into the agreements and leases for agricultural tenancies, forbidding the culture of flax, hemp, and woad, have no doubt tended to strengthen this conviction in the minds of those who have not possessed the opportunity of practically testing the truth of this very current opinion. It is most undoubtedly true that flax in itself, like all other crops, whether cereal or others, is certainly an exhaustive one: few crops are, however, more exhausting than wheat; but the farmer does not refuse to grow it on that account, as he knows that a great proportion of the crop is usually returned to the soil. Now, there are two modes of testing the accuracy of the opinion with respect to the injurious effects of the flax crop, viz., by chemical analysis of the constituents of the plant, and by that still more satisfactory and convincing test—the result of practical experience. Tried by either or both of these, it will be found, under a judicious mode of treatment, analogous to that pursued by the grower with respect to his other crops, that flax, so far from being an injurious, will be found, independently of its other advantages, to be of greater value than any other crop in keeping the land in a profitable state of productiveness, and preventing the possibility of its deterioration.

If the construction of the plant be closely examined, it will be found that those portions of it which absorb the alkalies, and the nutritive properties of the soil, are those which are not required for the purpose of manufacture, viz., the woody part of the plant, the resinous matter, and the seed. The capsules of the seeds, the husks of the capsules, and the seeds, contain a very large proportion of nitrogen and phosphoric acid, and may consequently be advantageously employed for the purposes of manure or for the feeding of cattle. The fibre of the plant, which is that portion required for manufacture, consists of about 47 parts of carbon in 100, united to the elements of water—in fact, oxygen, hydrogen, and carbon are its principal constituent parts, and they are derived not from the soil but from the atmosphere. 100 lbs. of flax fibre has been found by recent experiments to contain not more upon an average than 2 lbs. of mineral matters, including lime, magnesia, oxide of iron, carbonic, phosphoric, and sulphuric acid, and silica.

In cases where, in the course of preparation of the flax, the seed and the whole of those portions of the plant which have absorbed the nutritive matters from the soil, are destroyed by steeping, and where nothing is left to be returned to the soil, there can be no doubt that the crop is an exceedingly exhaustive one; and in the present advanced state of agriculture, it would be a vain and absurd attempt to endeavour to induce the farmer to grow flax upon such conditions. The last report of the Royal Irish Flax Society gives some particulars of the flax crop of fifty-one farmers in the county of Down, not one of whom saved the seed; and, although the average gain was £7 1s. 4½d. per acre, their example is one which is not likely to be very generally followed by enlightened agriculturists.

But apart from the deductions of chemical science, or theories founded upon the structure of the plant, the recent proceedings of the Royal Agricultural Society have completely set the question at rest. Mr. Beale Brown, who has devoted the last seven years to the culture and preparation of flax in the county of Gloucester, stated, at the meeting of the society on the 26th of February, that flax, deriving, as it did, a large amount of its nutriment from the atmosphere, was the least exhausting crop that could be put into the ground, provided the manure from the seed and refuse were retained on the land, and only the flax fibre itself carried off; and he had reason to believe that this opinion was now entertained by all parties connected practically with the cultivation of the flax crop.

Mr. Druce, of Ensham in Oxfordshire, also stated that flax was not an exhaustive crop; that he grew turnips in the same year on his flax land without manure, and that his son had found that some wheat sown after flax was one of the best crops he had ever grown. In Somersetshire it is a standing proverb that "good wheat crops always follow flax." Lord Monteagle also gave the result of his own experience, in connection with the growth of flax upon his land in Ireland, and said that some of the land which he had sown with it had been previously rather exhausted, but, by cultivating the crop well, that land had become better than any other on his estate; no meadow, indeed, yielded such capital grass as that on which the flax had been grown.

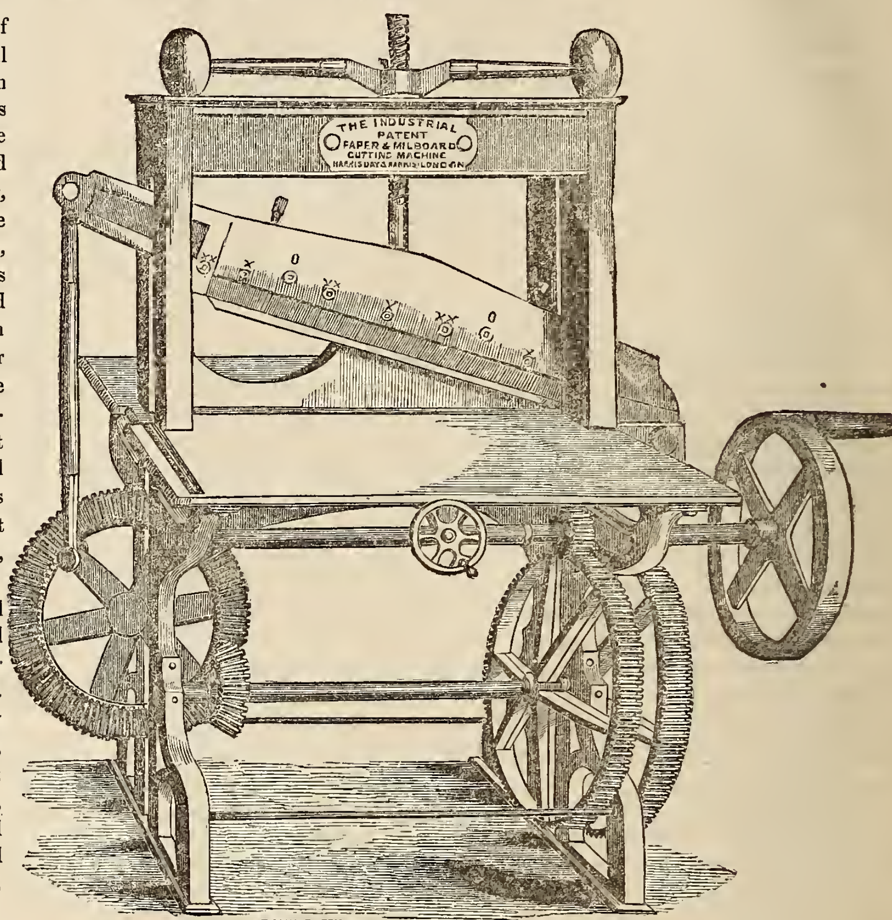
But it might be imagined that the demand was limited, and perhaps fluctuating. What says the *Morning Chronicle?*—

Perhaps the most remarkable feature connected with the cultivation of

flax in this country is, that almost in the same proportion in which the demand for flax has increased, the supply has diminished. In 1757, before the first machinery for spinning flax was erected in Great Britain, Ireland consumed all the flax which she produced, and imported from foreign countries to the value of £140,000. In 1816, during the existence of the Linen Board, Ireland, instead of being a flax-importing country, actually became an exporting country to the extent of £72,500. In the year 1841 there were in Ireland, employed in the linen trade, 41 mills, with 260,000 spindles. There are, in the present year, 73 mills, with 339,000 spindles; and adding the new mills now being built, and the additions of machinery now making to existing concerns, there will be, by the end of this year, about 400,000 spindles in operation. Comparing the relative proportion of acres of flax grown with the number of spindles at work, it would appear that in 1841 the number of spindles was 3.1 times greater than the number of acres of flax, whereas in 1849 they were about 5.6 times greater. The cultivation of flax has fallen off in Ireland since 1841 nearly 25,000 acres, while the quantity grown in 1849 did not amount to one-half ofthat grown in 1844.

(To be continued.)

DAY'S PATENT PAPER AND MILLBOARD CUTTING MACHINE.



The spectator, who for the first time sees one of these paper cutting machines at work, cannot fail to be struck with the ease and celerity with which such a simple combination of moving parts performs the work of several men. It is to the printer, the bookbinder, the paper maker, and various kindred trades, what the planing machine is to the engineer, and that is saying a great deal. Besides these trades, it is employed for cutting flannel, leather, silk, cotton, &c., and similar fabrics, as well as for making the innumerable paper and pasteboard boxes consumed in the various businesses in which they are found so useful. The removal of the paper duty would give an immense impetus to the use of paper for these purposes. In Paris, the purchaser of any fancy article, not of the very lowest value, instead of having a brown paper parcel handed to him, which probably comes to pieces before his journey's end, is presented with a neat paper box to hold the purchased article. We shall, perhaps, have the same in good time.

The knife, it will be observed, has a loose steel edge, which facilitates the sharpening. One end turns upon a pin fixed in the framing, and the other is moved by a connecting rod and crank below. Motion is given to the crank by a hand wheel, or by steam power, through the wheels and pinions, which admit of two speeds being given to the knife; a slow one for engine-sized papers and millboards, and a faster one for the more easily cut tub-sized papers. The paper is placed on the table, and squeezed in a solid mass by the plate and screw, which is worked by hand to any desired height.

LESSONS TO BE LEARNT FROM THE GREAT EXHIBITION.

(Continued from Vol. IX., page 241.)

We have already pointed out what we conceive should be the objects and aim of an Industrial Exhibition. As a means of education it should hold the first rank, and this place it would inevitably take, if it depended solely upon public support. The British Museum we consider an expensive example of what ought *not* to be done. With the exception of the library, that vast collection is literally a *show*, and nothing more. When compared with the western half of the Great Exhibition, it is like nothing so much as one of its own mummy-cases—curious, certainly, but not of much use. As far as the public individually are concerned, it would be an excellent speculation to let it, with all its contents (save the library), to the proprietors of the Polytechnic Institution, who would inspire it with some life, and make it at least represent the progress of the age in the arts and sciences. The chilling hand of a Government Commission would only fetter the energy of those to whom its details of operation would be entrusted; and we should infinitely prefer to see such an Exhibition as we hope to obtain, under the management of the Society of Arts, than to have it reduced to a state of lifeless formalism under the influence of Government management. We shall be met, we have no doubt, with the ready argument that the Great Exhibition of 1851, the close of which we so much deplore, *was* managed by a Government Commission. This is true to a certain extent only. Had it rested with the Government to originate the Exhibition, we should have had a building after the Houses of Parliament fashion, and a collection *à la* British Museum. It was not until they saw that the movement would go on without them, that they undertook its management; and in all those matters, on which public opinion was not forcibly expressed, they betrayed a narrowness of mind, ill according with the world-wide character of the project. It will only be fair to descend to particulars. The announcement of money prizes, after the fashion of a local Agri-

cultural Society, proved, as was foreseen and foretold, an apple of discord. Indeed, it was so evidently absurd, in an Exhibition of all Nations, that it was speedily abandoned, to the great disappointment of a large number of competitors, who had commenced preparations on the strength of the promises first held out. Money was esteemed too vulgar a reward, and, moreover, rather expensive; it was therefore determined to make it a question of honour. A bit of bronze, value one shilling, stamped with the approbation of an infallible jury, was to represent a £10,000 prize. It is almost laughable now, to contemplate the stupendous self-sufficiency of a body of men, who thought themselves competent to adjudicate between the conflicting claims of the leading manufacturers of all nations, as if it were possible to adopt any common standard by which the productions of all could be fairly judged. It was too ridiculous, and accordingly it was at last announced that the prizes meant—nothing,—a sorry ending for such a magnificent commencement. The announcement, however, insulted both those who did, and those who did not, obtain medals; and an amount of ill-feeling was engendered, at all events, amongst our own countrymen, which it will require some years to remove.

(To be continued.)

STEAM CORN MILL, AS CONSTRUCTED BY M. DELNEST, OF MONS.

The high reputation which French flour bears in the English market, proves that the French millwrights well understand their business; and indeed the assertion was hazarded in Parliament last Session, that the complaints of the English millers, against the importation of Foreign flour, arose from the inferiority of their machinery, and that it was only by adopting the improvements of their rivals, that they could hope to compete with them. The millers thought free trade an admirable doctrine so long as Foreign *wheat* only was imported; but when the *flour* came in the case was changed, and hence the complaints alluded to.

We have no reason, at present, for believing that there is any real superiority in the French machinery over the best constructed mills in this country; but we have a vast number of mills at work, of an inefficient character, which give our flour a lower *average* quality. Whichever way the case may be, it can do us no harm to see what our neighbours are doing, and we propose, therefore, to devote some of our space to this subject.

The mill, of which we have given an engraving, plate 1, is the invention of M. Delnest, of Mons, engineer, constructed on a system which he has patented in France, where, as our readers know, mechanical genius is not fettered by being compelled to pay heavy penalties for legal protection for its ideas.

The object of the arrangement is to simplify and cheapen the construction, without diminishing the efficiency of the machinery. In ordinary mills the fly-wheel is fixed on the crank shaft, and consequently requires to be of large diameter, to make its velocity at the circumference superior to that of the mill-stones. Regularity of motion is, we need hardly say, indispensable to good grinding, and this can only be attained by using a fly-wheel of adequate velocity, to prevent backlash in the teeth of the wheels. This may be done by putting the fly-wheel on a separate shaft, and using gearing to get up the speed; but the expense and complication of this method has led M. Delnest to design the plan before us.

Plate 1, drawn to a scale of half an inch to a foot, shows an elevation and plan of a horizontal high pressure steam engine, and two pairs of stones. The engine and gearing are placed in the ground floor of the mill, and the stones in the floor above. The sole plate of the engine, *a, a*, is cast in one piece, and is only of sufficient length to receive the cylinder and guides, instead of being continued to carry the crank-shaft. The guides are flat, and of cast iron, and the bearings *b, b*, of the weigh shaft, are cast on them.

The slide is worked by a return crank and shaft *c*, which is designed to give facilities for altering the stroke and lead of the slide, so as to vary the expansion; on the end of the shaft *c* is keyed a face plate, and the pin of the eccentric rod *d* is fixed into a similar plate. These two plates are bolted together, in the position required for the action of the slide, and can be easily adjusted by stopping the engine, and slacking the bolt. Where the work on an engine is of a fluctuating character, it is advisable to make the expansion acted upon by the governor, so as to come into operation without the intervention of the engine driver, and without stopping the engine; but in a flour mill, where the work is only occasionally changed, and with a small engine, it is hardly worth the extra complication.

The plummer-blocks carrying the crank-shaft are bolted on plates to the masonry which forms the foundation of the mill. The vertical shaft *e*, is driven through the bevel wheels *f* and *g*, and is carried up through the floor to drive the rest of the mill work. The spur-wheel *h*, which makes about 89 revolutions per minute, drives the two pinions *i, i*, and the stones at 120 revolutions. The fly-wheel *k* revolves nearly one-half quicker than it would do, if it were fixed on the crank shaft, and takes up less room, being completely out of the way. This is effected with the least possible gearing and friction in this arrangement.

It is obvious that three pairs of stones might be arranged round the centre vertical shaft, for a larger mill. For colonial use a mill of this kind would be very suitable, as it is self-contained, and therefore easily fixed, and there are no parts of any great weight. If any difficulty were apprehended about the foundations, it would be easy to cast a sole plate to take the crank-shaft plummer-blocks and the columns carrying the millstones. A timber foundation would then suffice, and the extra cost would be more than compensated for, by the saving in the erection—skilled labour being always expensive, and often unattainable, in the colonies.

FORBES'S REGISTERED DRAIN PAVEMENT.

This is a simple and effectual arrangement designed for the pavement of cattle lairs, breweries, wash houses, dye houses, and other places where water is being constantly spilt. It consists in forming each paving brick with a groove down the centre as shown in fig. 1. These bricks (thanks to the repeal of the excise) may be of any convenient dimensions; but the inventor finds that about a foot in length, and five inches in breadth, forms the most convenient dimensions. The groove is about half-inch wide at the top, and widens out at the bottom, as shown, to prevent choking.

The pavement being laid at a slight inclination, all the liquid will flow to the lower end, where it is intercepted in a cross drain, shown in fig. 2, covered with a loose tile or board, to make it flush with the

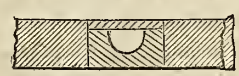
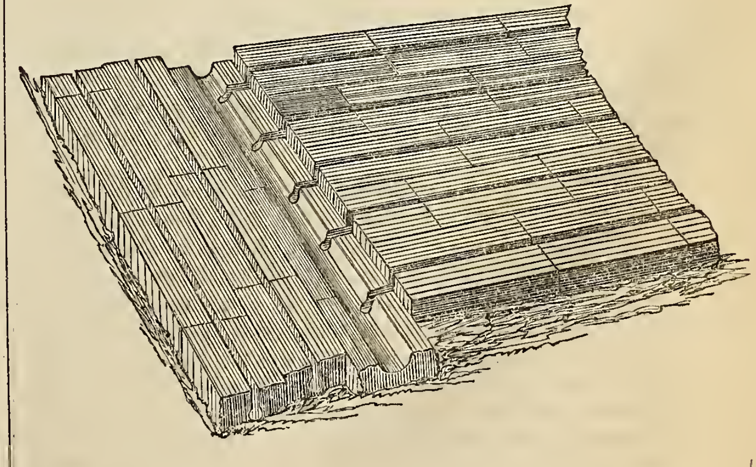


Fig. 2.

Fig. 1.

rest of the pavement, and to prevent its being filled up. Passages are formed in the sides of the cross drain-bricks to meet the channel in the

Fig. 3.



pavement. Fig. 3, is a sketch of a portion of the pavement laid as described.

The great use for this pavement will probably be for the stalls of agricultural stock, and, in cases where straw is dear, will effect a great economy. The plan which Mr. Mechi and other agriculturists have adopted, of putting the cattle on a sort of wooden gridiron (if we may be allowed the *bull*), is open to several objections. The cattle suffer in their hoofs, and are not at ease, and consequently do not fatten so fast; and the wood absorbs the liquid and the effluvia, and rapidly decays; besides giving out a stench which cannot but be prejudicial to the health of the animals. These objections are all overcome by the plan before us. The bricks are indestructible, and the price at which they can be manufactured is stated to be about 2½d. per square foot.

CARLSON'S PATENT DIRECT ACTING ENGINES FOR THE SCREW PROPELLER.

The plate of these engines, which we gave last month, will be found suggestive to the draughtsman and designer of engines for the screw.

We have never failed to express our conviction that geared engines for the screw will ultimately be given up in favour of the direct acting ones, and we believe that, just as firmly as we do that the direct acting system in locomotive engines will never be abandoned and gearing substituted. The same difficulties which are felt with direct acting screw engines were felt with locomotives, *and were conquered* by judiciously adapting the means to the end. In place of being an objection, it ought to be considered rather an advantage, that the screw admits of a high velocity of piston, whereby we can diminish the weights and space occupied by the machinery. We have seen instances where a pair of screw engines have occupied more space than they would have done had they been applied to paddle wheels. In fact they were a pair of oscillating engines, as constructed for a paddle wheel boat, put lengthwise into the ship, and occupying nearly double the length in the vessel they ought to have done. It is only in very large vessels that advantage can be taken of the room over low screw engines, and even then it interferes with the ventilation and the facility of getting at the parts for repair. On these accounts, then, it is desirable to place the cylinders in a line, and opposite each other, as in the case before us, in which one crank pin serves for the two engines. The strain between the piston and the crank shaft is taken by a wrought-iron framing, against the ends of which the cylinder flanges abut, and lateral stiffness is obtained by making the cylinders act as distance pieces between the transverse bulkheads, to which they are bolted. The slide faces project through the bulkheads, and are thus perfectly accessible for examining, or facing up.

All the moving parts are designed to save weight, in order to admit of high velocities. The piston is a simple casting of a dished form, which gives great strength and a much more convenient means of fixing the piston rod, than the pistons as ordinarily constructed. Its dished form admits of the piston rod stuffing box being sunk into the cover, which shortens to that extent the distance between the cylinder and the crank shaft.

The air-pump is not only worked at the same speed as the piston, but the valves are of metal instead of vulcanized India-rubber, as has been commonly used, under similar circumstances, in this country; yet the patentee affirms that air-pumps on this construction have been working for a considerable time at a speed of from 300 to 400 feet per minute, and making from 70 to 120 double strokes per minute without inconvenience. The air-pump bucket, it will be observed, is a solid bucket, the packing being accessible from the upper end. The pump draws in the water and air from the condenser, on making its upper stroke, and as the air occupies the higher place the rim of the bucket first strikes the elastic medium, which sets the water in motion with less concussion, the air forming a spring between the bucket and the water. The valves are of metal, of the spindle variety, and are of a parabolical shape, so that they are pressed equally over their surface, and gradually lifted. Spiral springs on the spindle have been employed by the patentee, to cause the valves to shut more quickly.

English engineers, who might hesitate to follow Mr. Carlson's example in the construction of air-pumps, may choose a middle course, by applying a small engine to work the air-pump alone, and one air-pump and condenser would then suffice for the two cylinders. The position of the cylinders would entirely prevent any risk of water getting into them from the condenser, which might be placed at the bottom of the vessel.

There is a degree of ingenuity about these engines, which entitles Mr. Carlson to great credit. We understand that he has constructed a great number of engines on these and other plans, which have earned for him a high reputation on the continent.

THE IMPENDING STRIKE OF ENGINEERING ARTIZANS.

It is with deep regret that we have witnessed the present attempt, on the part of the engineering artizans, to coerce the leading firms of London and Lancashire; and our concern is the greater, because the grounds put forward by them are so absolutely untenable, that their best friends are utterly precluded from accepting their defence. For nine years the conductors of this journal have been occupied in raising the social and educational condition of the artizan classes, and we have never hesitated to speak out in plain and unmistakeable language, whenever we conceived their interests were at stake. We are not, therefore, afraid that in the present instance our motives will be misunderstood or misrepresented by any whose character lends any weight to their opinion.

The history of the present movement, as far as we can learn from the statements of the men themselves and their representatives, is briefly this. Early in 1851, under what circumstances does not now concern us, Messrs. Hibbert and Platt, of Oldham, signed an agreement with their men, which we find given at length in the *Operative*, a weekly journal representing the Amalgamated Engineers' Society. They are styled—" Resolutions of a meeting of engineers and machinists of Oldham, held February 6th, 1851, and agreed to by Messrs. Hibbert and Platt:—

" No. 1. That in future, all planing, slotting, shaping, and boring machines, at the workshop of the undersigned, be worked either by mechanics or apprentices, to be taken up by them as they fall vacant.

" 2. That the labourers at present employed upon those machines, be not unduly interfered with before Christmas, 1851, when the machines shall fall entirely into the hands of the mechanics; but if any of the labourers are discharged, or the machines otherwise become vacant, the vacancies shall be filled up by the mechanics as they occur.

" 3. (Stipulates for the discharge of an obnoxious foreman.)

" 4. That systematic overtime be abolished, and any claims for exemption be referred to the District Committee."

In a circular sent to the *London* firms, and from a letter from Mr. W. Newton, member of the Council, in the *Times* of 25th instant, the abolishment of piece-work and overtime (except in cases of breakdown, when double time is to be paid) is demanded, and Mr. Newton expressly disclaims the demand for the discharge of labourers. We are very glad to hear that; but it is somewhat remarkable that Mr. Newton formed one of the deputation which waited on Messrs. Hibbert and Platt, and requested them to accede to a condition under which the whole of the machines would be placed at the disposal of the mechanics, under pain of a strike on the ensuing 17th of the month. We cannot therefore but infer that the same demand would have been made in London, as it is not pretended to be denied that the proceedings in both places are

under the direction of one and the same amalgamated society. But we are content to take Mr. Newton's own accouut of the case, and we will therefore only discuss the two acknowledged points—the abolition of piece-work and overtime.

The result of the piece-work system is this, that each man earns exactly what his skill and industry entitle him to, and no more. Wherein the injustice of this principle lies, we confess we are unable to point out. The *advantage* we have found to be this, that the difficulty of doing justice to each man respectively, on the day-work plan, is thereby entirely obviated. Every one who has ever had to employ engineers, knows that he may have two men, working side by side, one at five sbillings a day; aud if that man be worth five shillings a day, the other is fairly worth ten, and yet he is only receiving six shillings. And moreover, if it were attempted to raise the wages of the better man, the other would immediately expect to be raised in the same proportion. Do we find this system of an equalization of wages hold good with any mercantile or professional business? Does the clerk at £50 a year strive to reduce the salary of his more talented fellow-clerk, who gets his £300 a year? Or does the barrister, as yet unknown to fame, refuse five guineas with a brief, because a leading man would get fifty? The advantage of piece-work is, that it tends to counteract this unfair equalization of wages, which practically takes place, and which taxes the industrious to pay the idle. But Mr. Newton says, "He cannot assert that we (the Council) have advocated equality of wages; on the contrary, we have always repudiated tbe doctrine. If such a proposition had been made in our Council, it would have been laughed at." What is the objection, then, to piece-work? With respect to overtime, we admit it to be bad in principle, and injurious far more to the masters than to tbe men; but can engineers obtain an exemption from the ordinary fluctuations of trade? Take farm labourers, who are compelled at barvest time to work sixteen or eighteen hours a day; or printers, who are compelled to work all night towards the end of the month or the week; in what do the cases differ? Indeed, is it likely that any employer would work overtime, if it could be avoided, when he has to pay for $2\frac{1}{2}$ hours instead of 2, and does not get in reality more than $1\frac{1}{2}$ hour; for it cannot be expected that a man who bas done 10 hours' good work is able to work with the same vigour for anotber quarter of a day. The effect of abolishing overtime entirely would be to draw an additional number of men into the trade, whenever it became prosperous, and these men would eitber accept lower wages, when trade became bad, or would emigrate. The ultimate effect in either case would be to deprive the really hard-working man of all opportunity of making a provision for old age.

If we are to believe that these demands are required by the most industrious and skilful workmen, how is it that that class have always been the most eager to take advantage of working overtime when trade was good? We bave put tbe question so far, entirely as it concerns the emolument of the men; but we entreat them to reflect that this is no one-sided question. Those who object to overtime and piece-work are at liberty to refuse either; but let them beware how they attempt to dictate to their fellow-workmen wbo entertain a different opinion. The spirit of the age is running in a direction so entirely opposite, that any such attempt cannot fail to bring with it its own punishment.

REVIEWS.

A Treatise on Agricultural Buildings. By JOHN EWART, Law Surveyor. London: Longman aud Co. Newcastle: Messrs. Lambert.

THE progress of agricultural literature argues well for the advancement of the art of Husbandry, and it is with pleasure that we see such works as the one before us issuing from the press. Tbe supply denotes a demand, and the demand shows that landlords and farmers are not willing to be beaten in the race of competition, to wbich they, in common with the rest, are now exposed.

Mr. Ewart's work contains a very complete set of plans of buildings for farms of various magnitudes, conducted under both tillage and grazing systems, with specifications and estimates; although, as he justly remarks, detailed estimates are no criterion, because the prices of materials and labour vary in every locality. A very good plan is adopted, to show the effect of alterations and additions to buildings so designed, by attaching to the plates, supplementary leaves, which are fixed at one edge only, and can be lifted up to show the arrangement beneath. A comparison is thus more readily made, and tbe effective number of plates increased. The plates are on a large scale, and, as well as the letter press, bandsomely got up. Altogether it is a work to which we can give an unqualified commendation. At another page we have given an extract on the subject of the construction of cattle lairs, in wbich the much disputed question, as to the respective merits of the fold-yard and loose box systems for cattle, are discussed.

A LESSON ON SCYTHE MAKING.

MR. CHARLES HARDY, of Lowmoor, the well known iron-works in Yorkshire, has lately speeified a patent (dated 15th April, 1851), for improvements in the manufacture of scythes, in whieh he gives such a eomplete history of the affair, that we cannot refrain from quoting it from the *Patent Journal.*

"Hitherto," says Mr. Hardy, "scythes have been made from iron and steel welded together. The process the patentee employs, is to take a bar of steel, which may be of the natural or cemented kind, hammered or cast. The weight of the seythe to be fabricated being known, that of the steel to be employed is easily proportioned. The bar is guaged and divided into portions representing the weight neeessary for one seythe, by placing the bar in a tube, into which is introduced, either before the bar or at the same time, and successively once for eaeh division, an iron or steel guage, graduated, and upon whieh a moveable stop is fixed at the point corresponding to the required weight. The tube being full of water, the guage is introduced, which displaces a quantity of water equal in volume to that of the guage; the bar is then introduced to sueh a length as to cause the water in the tube to reach the level of the orifice. Thus the volume of that portion of the bar introduced into the tube will be found to be exactly equal to that of the guage previously introduced. A mark is made aeross the bar with a brass point, and the same operation is continued, until the whole of the bar is guaged. Under a hammer, moved by water or steam power, of about 2 cwt., the workman, at one heat, draws out the bar of steel to about the length of the seythe, of a blade-shape, and of equal thiekness throughout to that of the back of the seythe. Under the same, or a similar hammer, a workman draws out the handle of the seythe, and gives it its curvature. Another workman forms the point of the blade, and turns up the extremity of the handle. The scythe is then bevelled under a hammer of about 3 cwts.; it is widened by the workman in such a manner as to retain the rib, and thin off the blade gradually to the edge. This operation is performed in about four sueeessive manipulations, varying more or less, according to the length and width of the seythe; after which it is handed over to the workman whose duty it is to set off the rib, and to give it the required appearance; then, under a small hammer of about $1\frac{1}{2}$ cwt., it is planished cold, to trim it and give it a regular form. In this state, the edge of the seythe is cut out by the beam-eutting maehine, or by the hand-shears; it is thus finished, and ready for hardening. The hardening is done either with coal in a furnace of a peeuliar description deseribed, or with coke, or wood charcoal, in open furnaces. When the seythe has been brought to a red heat, be it somewhat higher or lower, aeeording to the quality of the steel used, it is to be entirely immersed in a bath composed of beef suet and mutton fat, mixed with about an equal portion of resin deprived of water. Upon taking it out of the hardening bath, it is dried in powdered ehareoal, and then, while hot, it is beaten in water, after having been slightly heated; or better still, it is washed in boiling water, which removes every partiele of grease, and then it should be slightly heated, and beaten in cold water. In this state it is reheated and annealed in sand, that is to say, it is reheated by covering, and annealed sueeessively, with red-hot sand, until every portion of it beeomes a blue, violet, or other eolour, according to the degree of hardness whieh it is desired to give to the seythe. If it be desired to sharpen the seythe on the grindstone as is eommonly practised, the seythe is hardened at a somewhat greater heat, and reheated and annealed at a somewhat less heat, by which it is rendered harder. It is then finished aecording to the processes commonly used for the ordinary seythe of iron and steel. But if it be desired to make a scythe of great perfection, the first reheating and annealing must in general be carried as far as the blue eolour, or even somewhat farther. After this reheat and annealing, the scythe, although it has kept its edge sufficiently hard, has acquired a certain malleability, and is able to support hammering

without breaking. Before the hammering, or even before the reheat and annealing, according to the colour and appearance desired to be given to the scythe, it is scraped with a steel scraper; and as soon as it becomes perfectly white all over, it is reheated and annealed in sand, to bring it to the desired colour, after which it is placed under a small hammer, of about $1\frac{1}{2}$ cwt., making about 300 strokes per minute, having on the anvil, as well as the hammer, a block of cast steel, tempered hard, polished, and shaped according to the form it is desired to give the scythe. Under this hammering, the scythe-blade receives a brilliant polish, and becomes perfectly smooth. The finisher, with a small polished hand-hammer and an anvil similarly polished, goes over every portion of the scythe upon the anvil, and with gentle blows of the hammer gives it a proper appearance, and removes any small flaws that may have arisen. According to what is necessary, with regard to the state of perfection to which it is desired to bring the scythe, the successive operations of planishing and finishing are repeated several times, to which may also be added, if required, one or several reheats and annealings before the planishing. The last or finishing operation is performed by a more experienced workman, well versed in scythe-making, who in a few moments rectifies whatever small defects of form may have arisen, and gives every portion the proper definitive form. After this operation there only remain two things to be done; the first is, to give a small touch along the edge on the grindstone, to remove any slight unevenness or inequality which the shearing may have left, or the planishing and finishing may have produced. The edge is given by applying the planishing hammer to the edge only of the scythe. Under this hammer it becomes perfectly keen, and so formed as to enable the mower to use the scythe at once, as if it had been done on the stone. When this operation has not been performed, the mower gives the edge himself, by means of a small hand-hammer with a cross end, and a small portable anvil, composed of a vertical stock, from nine to ten inches long, with a head like a hammer, of about one inch square, and finished in the middle with a cross piece of an 8 shape, or other analogous form. He then passes the hand-stone over the scythe, as ordinarily practised. This scythe is much less brittle at the edge than the common scythe sharpened on the stone. The edge can be kept equally good, hard, and tough along the whole width of the scythe up to the point; and when the scythe is worn out, it is not a mixture of iron with a few shreds of steel which remains, but a piece of excellent steel, which can be rendered very serviceable and advantageous for agricultural purposes. Lastly, to protect the scythe from the effects of rust, it is varnished over with a coat of copal varnish, which is spread over (the varnish being melted and the scythe heated), by means of a small brush, and is used as thin as possible.

ABSTRACTS OF RECENT ENGLISH PATENTS.

John Ashworth, of Bristol, manager of the Great Western Cotton Works, *for certain improvements in the method of preventing and removing incrustations in steam boilers and steam generators.* May 29th, 1851.

The following mixture is to be put in the boiler, in the proportion of one gallon to 30 horses power, every three or four days.—

32 gallons of coal tar,
21 gallons of linseed water,
6 lbs. of pulverized black lead,
8 lbs. of Castile, or common soap.

The linseed water is prepared by boiling in it 14 lbs. of linseed. This mixture, it is stated, will not only prevent future incrustation, but will remove that already on the boiler. In the *Artizan* for July last, we stated, on the authority of the *Scientific American*, that coal tar had been tried in the United States, and found more efficacious in preventing incrustation than any other material.

A. V. Newton, of Chancery Lane, *for improvements in the carbonization of coal, and in the utilization of the products disengaged during that operation; in improving the qualities of the products intended for illuminating purposes, and in regulating the same.* May 27th, 1851.

This invention is designed to produce gas coke of equal value to that at present known as oven coke, and the gas from which is not withdrawn so as to make use of it for illuminating purposes. This is proposed to be attained by using large ovens instead of the smaller sized gas retorts, and by cooling the coke without the access of atmospheric air. An oven and a cooling-chamber are so arranged, that by opening a sliding door between them, the coke will slide down from the oven to the chamber below, whence it is removed when sufficiently cooled. The oven is then filled, without loss of time, through a sliding door in its higher side. The oven is heated by furnaces beneath, in which either coal, or the gas produced in the oven, may be used. The cooling chamber is surrounded with channels, through which the atmosphere is allowed to circulate, in order to reduce the temperature.

The method of regulating the passage of the gas, is by means of a small gasholder, acting on a throttle valve.

We doubt whether distilling coals in such masses as the inventor seems to contemplate, will produce gas so good, either in quantity or quality, as where the coals are distributed over a larger surface. Circular retorts are found objectionable on this principle. The system of filling and discharging seems ingenious, and likely to be effective. The governor does not appear to offer any advantage over the ordinary one, and seems more liable to stick from the action of the tar, &c.

Archibald Slate, of Woodside Iron Works, Worcester, *for improvements in steam-engines and steam-boilers; and in the passages and valves for the induction, eduction, and working of fluids.* May 27th, 1851.

The improvements in steam-engines consist in placing the steam cylinder within a larger cylinder, and making the slides of annular rings, filling up a portion of the space between the inner and outer cylinders. By this means, the ports are nearly the whole circumference of the cylinder in length, and consequently a very small travel of the slide will open a large area of port, and so enable the engines to be worked at a very high velocity. The same principle may be applied to the valves of pumps.

The improvements in boilers consist in making the stays in the fire-boxes of locomotives hollow, and open at the inner end, and closed at the outer. In this way the heat can pass into but not through them. The stays at the sides are proposed to be carried through the fire-box, to form water tubes, and give additional heating surface.

CORRESPONDENCE.

FORM OF THE SAILS OF VESSELS.

To the Editor of the Artizan.

Sir,—Whilst reading your interesting journal, I lighted on the following passage, p. 188, extracted from Mr. Bourne's work on the screw propeller. "Hooke says, (writing about horizontal windmills in 1681,) that there are certain first principles common to the sails both of windmills and ships, which it is important should not be transgressed, if an efficient performance is required; and of these, the first is, that the vane or sail upon which the wind impinges, shall be, as far as possible, a perfect plane, without any bellying, bunting, or curvity, such as is often to be met with in the sails of ships, and which nautical men commonly reckon as an advantage."

My object is, to call the attention of your readers to the manner in which this prediction has been fulfilled in the trials of the American yacht, *America*. Her success was attributed in a great measure, to the cut of her sails, which lay as flat as a board, without any bellying; and I think there can be no doubt that that principle is the correct one. Mr. Hooke was, it appears, two centuries in advance of his age, like many other men, who are only too far-sighted for the generation in which they live. I do not know what can be said in favour of the bellied sail, unless there exists some such idea as "that it holds more wind." But it appears to require but a slender knowledge of mechanics, to see that a body passing through a fluid, whether air or water, will be obstructed in proportion to the "immersed area," as shipbuilders say; and it is evident that a bellied sail, moving obliquely through the air, offers a greater surface for resistance than a perfect plane of similar dimensions. I understand that some experiments have been made at the Isle of Wight, with sails made of thin board, and I should be glad to hear, from some of your readers, with what success. It seems to me that a sail of this kind might be made so as to furl by shutting up like a fan, which might suit the material better than any attempt to imitate the rolling up of sail cloth.

I am, Sir, yours, &c.
Inquirer.

ON MEASURING THE WATER EVAPORATED BY BOILERS.

To the Editor of the Artizan.

Sir,—I am connected with a concern, having boilers working at 20 and 60 lbs. to the square inch, and as I have no means of guaging the feed water, I cannot correctly estimate the quantity of water evaporated; if, Mr. Editor, any your numerous readers would furnish a rule for ascertaining the quantity of water contained in a cubic foot of steam at each of those pressures, and supply proof of its correctness, they would give me the clue for arriving at the information sought, and would greatly oblige,

Yours very sincerely,
T. T., Jun.

P.S.—Are you aware of any metre being in existence, capable of measureing water with the accuracy required, and with a varying amount of pressure always acting against it?

NOTES BY A PRACTICAL CHEMIST.

Combination of Arsenious Acid with Albumen. — It has latterly been maintained by Liebig and Muspratt, that arsenious acid is capable of forming with albumen a definite and moderately stable compound, and that this reaction, in fact, determines the poisonous effects of arsenic when introduced into the system. Other chemists, again, maintain, that no true combination takes place, but that the arsenic is merely entangled in the albumen in a mechanical manner, resembling the action of animal charcoal upon the vegetable alkalies, and other organic bodies. This latter opinion is especially supported by the experiments of Mr. Edwards, who finds that the so called arsenite of albumen may be completely freed from arsenious acid by means of boiling water, if previously triturated so as to "break up the mechanical net-work of the coagulate." Herapath, who has recently examined the subject, has obtained results to a great extent confirmatory of those of Edwards. The quantity of arsenious acid remaining in the albumen, after washing, was a scarcely appreciable trace not near the atomic proportion (0.632 per cent.), 483 grains of albumen having been treated with 3 grains of arsenious acid, the washings were found to contain 2.921 grains, so that only 0.079 grain remained in the albumen. It was found, moreover, that the poisonous properties of arsenic are not perceptibly modified by previous treatment with albumen in excess. It need scarcely be added, that these experiments, unless some unsuspected source of error has crept in (which, from the simplicity of the process, and the character of the operator, is highly improbable), must be fatal to Liebig's theory.

Test for Iodate of Potassa in Iodide of Potassium.—When iodide of potassium is exposed to a high temperature in a porcelain or iron vessel, iodate of potassa, if present, is decomposed and converted into iodide, oxygen being given off. The presence of oxygen gas may, of course, be easily shown by introducing a lighted match into the mouth of the crucible. The weight of the remaining iodide, deducted from what was put into the crucible, shows the amount of oxygen lost.

Arsenic present in Vegetable Matter.—M. Stein finds, in 10,000 parts old linen, 0.11 of arsenic; in ditto rye-straw, 0.009; in ditto cow-dung, 3.0.

Direct Production of Cyanogen from the Nitrogen of the Atmosphere.—Rieken finds that carbonate of potassa, mingled with carbon, and exposed to a current of nitrogen gas, is entirely converted into cyanide of potassium, at the temperature at which potassium is reduced. This result proves that cyanogen and its compounds may justly be treated in inorganic chemistry.

Re-conversion of Chloride of Manganese into Peroxide.—In manufactories where chlorine gas is extensively used (as in the preparation of bleaching and disinfecting compounds), a considerable amount of the chloride of manganese is formed. This may be re-converted into pure peroxide by the following process. The chloride is dissolved in distilled water, and kept at a temperature of 86°—104°. Oxychloride of potassium, sodium, or calcium, is then added, until no further change of colour takes place in the precipitate formed. The supernatant liquid is then run off, and the precipitate washed with a mixture of one part nitric acid and 50 of water. The foreign metals are thus dissolved out, and the peroxide remains pure as a dark brown powder.

ANSWERS TO CORRESPONDENTS.

"B. B." Unless you have a practical acquaintance with the apparatus, &c., used in preparing prussiate of potash, we must advise you not to embark in the manufacture. The instructions you may find in books will conduct you merely to the Bankruptcy Court.

"Bird's-eye" is informed that we cannot, in conscience, reveal secret processes which have been communicated to us in confidence. Let him set his own wits to work.

"Pharmaceuticus." You are in error; tartaric acid has proved fatal in at least one case.

"X. P., Liverpool." The development of phosphuretted hydrogen gas from putrefying animal matter is a subject of dispute. Liebig denies it, as he maintains that phosphorus occurs in the body only as phosphoric acid, which would render the formation of the above deadly gas impossible. Those who consider that phosphorus is found in other combinations (such as Mulder's phosphamide), are of a different opinion. We are not in possession of any very delicate re-agent for phosphuretted hydrogen.

S.

STEAM TO AUSTRALIA.

(Concluded from Vol. IX., page 284.)

Captain William Watts—Has commanded the *City of Rotterdam*, *City of London*, *Sir Robert Peel*, and the *Hellespont* screw steamers, belonging to the General Screw Company, during four years and a half, and during the whole time has not had a casualty which has stopped the vessel an hour, or obliged her to put back into port; prefers iron vessels to wood for the screw. The *Hellespont* has been out three months, and has no fur on her bottom; on the two voyages out and home, to the Cape, her average speed was 8.47 knots.

The screw is always efficient in heavy weather. A vessel may sail within six points without the screw, and within nine points with the screw. In a run from Malta to Gibraltar, the *Hellespont* beat a Dutch paddle steamer, *William the First*, by spreading canvas as soon as the breeze freshened. In very bad weather, an auxiliary screw steamer would beat to windward with the aid of her screw, and perform a greater actual distance dead to windward than a paddle-wheel vessel of full power could do, steaming head to wind. Witness believes that vessels of 1,400 tons and 250 horse power would make an average of 8½ knots in all weathers in the Atlantic.

Captain John Hyde—Has commanded vessels for the last five years from London to Adelaide; believes that any vessel could make the voyage round Cape Leuin at even the worst period of the year; vessels are delayed in going round Cape Leuin more frequently from calms and light winds than heavy gales; believes that steamers would make the passage home in less time than the passage out, and that auxiliary screw steamers would maintain an average of 8½ knots. The average speed of sailing vessels, which witness has commanded, has been 5 knots.

Captain John Lane—Made two return voyages to India from Australia, in the worst months, and met with no very bad weather. The passage round Cape Leuin is commonly made by coasters at all seasons of the year; has no doubt the screw vessels proposed will easily accomplish an average of 8½ knots. Once commanded a barque, the *Isabella Blyth*, from London to the Mauritius—she was 443 tons, and was fitted with a pair of engines of 30 horse power, and paddle wheels which could be raised or depressed about 4 feet, so that when she heeled over, the wheels could be trimmed so as to keep them in the water. The steam was intended for calm weather, and propelled her at 4½ knots. The machinery was designed and constructed by Messrs. J. and A. Blyth (misspelt *Bligh*, in the report), engineers of Limehouse.

[This gentleman, we observe, has since taken the command of the *Harbinger*, one of the General Screw Company's new fleet.]

Authur Anderson, Esq., M.P.—Is the managing director of the Peninsular and Oriental Steam Navigation Company. That Company has made four separate propositions to government to carry out the Australian packet service;—the first is dated 17th July, 1848, and states, that in consequence of the uncertainty of the amount of freight and passage money to be obtained on the line, the Company proposes that Government should charter two steamers of about 800 tons and 250 horse power, and run them for twelve months, making six voyages between Singapore and Sydney; that the Government should be at the expense of coal stations, and that the Company

should man and coal the vessels, the estimate for which is £29,800, the Company doing all in their power to obtain freight and passengers, and performing all the Home and Foreign Agencies without charging any commission for the same. When the six voyages have been made, the profit or loss to be divided in the following way:—One-third to the Government, one-third to the Colonial Government, and one-third to the Company. That on the experience thus acquired as to the probable traffic, the service should be put up to tender for ten years, and that should any other Company than the Peninsular and Oriental obtain the contract, such Company should pay them their share of the loss, had they incurred any, by the agreement before mentioned. No answer was given to this proposal, and subsequently tenders were advertised for, for the Torres Straits route; in answer to which, the Company wrote, on November 2nd, 1848, in which they expressed their willingness to abide by their former offer, and to give up the re-payment to them of the one-third loss if there were any. They decline to tender for auxiliary screw-steamers, as punctuality would be indispensable in running in conjunction with the other lines. With full-powered steamers of 288 to 330 tons and 260 horse power, their estimate for a monthly mail between Singapore and Sydney was £60,000 per annum, and an additional £6,000 if the Government decline to take charge of floating coal depôts at Cape York and Sandy Cape. The Company have estimated the passenger traffic at only 10,000 per annum, on account of the great discrepancy of opinion amongst those best qualified to give an opinion; but they are willing to keep separate accounts, under the superintendence of a government officer, of their earnings under the heads of passengers and freight, and should it prove greater than they anticipate, they will deduct the net surplus amount from the contract sum, after allowing 26 per cent. for repairs, depreciation, insurance and interest. They also state, that should any other Company undertake the contract on more favourable terms, they will co-operate with them in the through traffic.

On the 13th January, 1851, in order to put on record previous semi-official communications, a letter was addressed to the secretary of the Admiralty (offering to postpone the consideration of the line between Bombay and Suez, which the E. I. Co., declined to relinquish) stating, that they were ready to establish the desired communication with Australia, in connexion with a line of steamers between Calcutta, Penang, Singapore, and Hong Kong, to be arranged so as to afford a twice-a-month postal communication between this country and China, and a direct steam communication between Bengal, the Straits settlements, China and Australia, excluding the Bombay and Suez service altogether, at a rate of 6s. 3d. per mile, being exactly the same *pro rata* at which they had offered to execute the whole service.

The last proposal was in answer to an advertisement issued by government, and is dated 13th February, 1851. It states that the Company is willing to abide by any of their former offers, or to carry the mails on the terms recommended by the Committee of the House of Lords, 1847, viz.—that the Company shall receive the postage of all letters they may convey, at not less than the rates now established, of 1s. per single letter not exceeding half-an-ounce. This offer has been officially declined.

It was proposed to take the western route between Singapore and Sydney, round Cape Leuin, both out and home, as that would give the greatest accommodation to the colonies. The vessel would first touch at Batavia, and, if necessary, at Shark's Bay, for coals; also for coals at Swan River, and St. George's Sound, then Adelaide, and then Port Philip (from which a branch steamer, provided by the colonial legislature, would take the mails for Van Diemen's Land), and thence to Sydney. At 8½ knots this would occupy 29 days, and would bring Sydney within 72 days of London.

If the eastern route were adopted through Torres Straits (see *ante*, p. 234), Sydney would be reached first; but it is supposed that this passage would delay a steamer more than calling at the ports on the western route, and that, therefore, Sydney would not receive the letters any sooner, whilst the other colonies would be prejudiced. Setting aside the question of the danger of Torres Straits, they involve coming round an immense tract of coast, where there are no settlements and no intercourse. Witness has examined a number of captains, and they have concurred in opinion, that there is no more difficulty in getting round Cape Leuin than in crossing the Bay of Biscay, nor so much.

English coal at Hong Kong costs from 50s. to £3; at Singapore, about 45s.; at Suez, from £4 to £5.

Witness is of opinion, from considerable experience in such matters, that no Company could have a fleet of 15 steamers, as proposed, built, and set running in 18 months. Witness knows Mr. Green, Messrs. Miller and Ravenhill, Mr. Penn, Messrs. Robinson and Co., Messrs. Napier and Co., and Messrs. Scott, Sinclair and Co. All these men are very respectable builders and engineers.

Q. 3330.—These men having guaranteed to find vessels within 18 months, should you consider that to be a sufficient guarantee that those vessels could be found?—I should not, decidedly.

Q. 3331.—On what ground?—Because, in my experience, those guarantees are worth nothing.

Q. 3332.—Then you would take no guarantee of any sort?—Not for time.

The Peninsular and Oriental Company contracted for 5 or 6 ships for the India service, with respectable parties, under stamped contracts, with a fine attached for loss of time; but it was impossible to enforce it, because the delay arose from causes over which the contractors had no control, although the ships were 12 months after time. It is possible to draw a contract under which the fine may be easily enforced, but it is not easy to get builders and engineers to take such a contract.

If the voyage from England to Sydney had to be performed at an average speed of 11 knots (as the latest Cunard and West India Mail steamers), it would be done at a most enormous expense.

(At a re-examination, witness hands in a time-table, calculating the speed at 10½ knots, which gives 62 days between London and Sydney, as against 72 days at 8½ knots. No statement is mentioned as to the extra charge for the higher speed.)

Witness has not had sufficient experience of auxiliary screw vessels to speak confidently of them; but is of opinion, that they could not be depended on for regularity. The whole postal lines concentrate at Point de Galle, where the Chinese Mail is transferred from the Calcutta steamer to the China line of steamers. Out of no less than 74 voyages, the steamers of the Peninsular and Oriental Company have always met at Point de Galle within 48 hours of each other, and there was only one occasion on which the China mail missed the homeward steamer. Witness does not think such regularity could be maintained by screw steamers, running in combination with paddle-wheel steamers. Has heard part of the evidence of Captain Matthews, but it has not shaken his opinion. The vessel he commanded was larger than could be put upon the Australian service, and his observations were confined to the homeward voyage.

The Peninsular and Oriental Company would have no difficulty in raising another million capital, as they have lately issued half-a-million in 50*l.* shares, of which only 5*l.* has been called; and they have a reserve fund applicable as capital.

[From not hearing the whole of Captain Matthew's evidence, probably, Mr. Anderson appears to have assumed that his remarks applied only to the homeward voyages, whereas it will be seen that he speaks of the average of both out and home.]

Captain B. R. Matthews—Was commander of the *Great Western and City of Glasgow*, and is now commander of the *Great Britain*. Has made 102 passages across the Atlantic, in steamers. Has made twelve voyages with the screw, and never had an accident with it; prefers it to the paddle-wheel. With light winds and smooth water would prefer a full-powered screw or paddle-wheel vessel; but in heavy gales, such as are said to be found off the Western coast of Australia, has no doubt that the proposed vessels will be able to maintain an average of more than 8½ knots. Those vessels witness has seen are better formed, have a greater rise of floor, than the *City of Glasgow*, and ought to make a better speed. The weather, in the Atlantic, it is presumed, is worse than on an Australian voyage, and the average of the *City of Glasgow* was 8 knots out and 10 home, or a general average of 9 knots. That exceeds the average of the *Great Western*, during the three years that witness commanded her.

The following are the particulars of five voyages of the *City of Glasgow* :—

OUT.	Days.	Hours.	
1st trip to New York	17	0	(detained with ice).
2nd „ „ .	14	6	
3rd „ „ .	15	8	
4th „ „ .	14	10	
HOME.			
1st trip from New York	14	6	
2nd „ „ .	14	14	
3rd „ „ .	15	0	
4th „ „ .	14	8	
1st trip from Liverpool to Philadelphia	21	6	
This trip the Mail-boats took 18 days to New York.			
1st trip from Philadelphia . .	13	15	

The worst speed witness ever made in bad weather was 160 miles in the 24 hours, that is through the water—say 120 miles on the direct course. Witness has known the *Great Western* make only 40 miles in 24 hours. In one of the voyages from Philadelphia witness made a greater average speed than the *Niagara*, a full-powered paddle steamer of Cunard's, which sailed, nearly at the same time, from New York.

The *City of Glasgow* is 300 horse-power, nominal, and witness supposes the highest power they were capable of working at was 500. At that power the consumption of coal was from 30 to 32 tons per day, and the highest speed, under steam alone, $10\frac{3}{4}$ knots. $\frac{30 \text{ tons}}{300 \text{ h. p.}} = 5.6$ lbs. of coal per horse power per hour. The screw could be disconnected, but not feathered. On one occasion, when the vessel was making $10\frac{1}{2}$ knots, with the engines and screw going, the screw was disconnected, and allowed to drag, which reduced the speed to $8\frac{1}{2}$ knots. It would not pay to lose 2 knots, and therefore the fires were never put out; but the consumption of fuel was reduced under such circumstances, with a leading wind, to 18 tons in 24 hours. This would be saved in the vessels witness has seen, because the feathered screw offers no obstruction to the vessel. Witness would bank up the fires, and keep the water at such a temperature that steam could be got up very quickly. Witness is only doubtful that in large screws there might be some corrosion or derangement, unless the screw were feathered pretty often; but he likes the principle. Witness is not an advocate for lifting the screw out of the water (in place of feathering it), not so much for fear of derangement of the machinery; "but when you are scudding, and you are caught suddenly by a heavy wind, you require the screw in action immediately to keep the vessel steady, and prevent the sea breaking over her stern; you are wallowing about in the trough of the sea while you are putting the screw in; the motion of the sea is terrific at that time, and you want the power of the screw applied immediately; you cannot afford to lose ten minutes in fixing the screw."

NOTE.—One of our correspondents has fallen into a slight error, by taking it for granted that the greater portion of this evidence is given in the words of the witnesses. The only part so given, a very small one, is marked by inverted commas. We have given the spirit not the letter.—ED. *Artizan.*

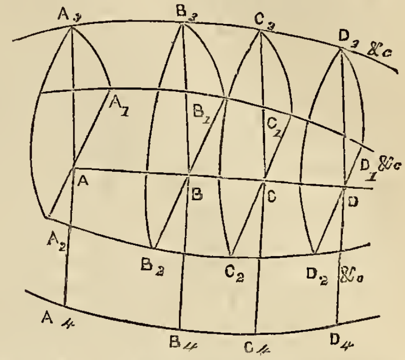
ON THE DYNAMICAL STABILITY OF FLOATING BODIES.

(Continued from Vol. IX., page 279).

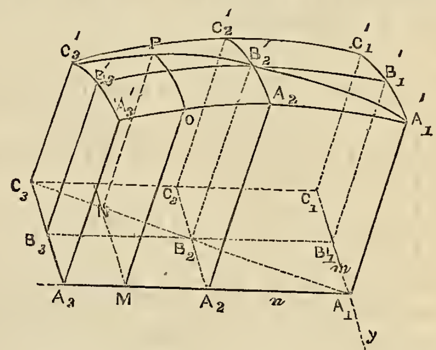
BY ROBERT RAWSON, PORTSMOUTH DOCKYARD.

(23.) *To approximate to the volume included by a curved surface and given planes.*

IT has been already observed, that the solution of this problem depends entirely upon the solution of the preceding; the only difference, then, between the two questions is, that in this, the units of area, which are obtained by the preceding rules, have to be summed in order to approximate to the required volume. The square units, contained in the sections into which the geometrical solid is divided, have the same relation to the cubic units in the solid, as the linear units contained in the ordinates of a plane curve have to the square units in the curve. Mathematically considered, all the difficulties in finding the volume of a geometrical solid are to be found in the solution of the problem of the quadrature of curved lines. And the principal question to be considered, in the approximation to the area of curved lines and volumes of geometrical solids, is, will the same rule of approximation which is applied to the former give results involving unimportant practical errors when applied to the latter? This question can be answered only in particular examples; but the remarks which have been made, and the formulæ which have been given, in the preceding articles, will be of considerable use in assisting those who may be engaged in computations of this kind, to select the best formula, to ensure a near approximation.



(24.) Let A A_3 B_3, &c., be a solid, contained by the plane A D, &c., and the curved surface A_3 B_3, &c. It is then divided into a convenient number of parallel sections, A A_3, B B_3, &c., at equal distances, A B = B C, &c., for the same reason that a plane curve is divided into a number of equidistant ordinates. The area of each section is then obtained by one of the foregoing rules, and perpendiculars, A A_4, B B_4, C C_4, &c., to A D, are drawn, making A A_4 equal to the area in the section A A_3, and B B_4 equal to the area in the section B B_3, &c., giving the curved line A_4, B_4, C_4, &c. Now, the area in square units included by the straight line A D, &c., and the curve A_4 B_4, &c., will represent the volume of the solid A A_3, B_3, &c., &c., in cubic units. The greater the number of sections into which the solid is divided, the nearer this process will approximate to the volume required.



(25.) This diagram will show the application of the foregoing rules to compute the immersed volume of a ship, an element by means of which the weight of the vessel and its contents can be readily obtained.

$A_{,}$ C_3, &c., is a plane about which the ship is symmetrical; that is, the ordinates $A_{,}$ $A_{,}'$, A_2 A_2', &c., perpendicular to the plane $A_{,}$ C_3, &c., and extending to the outer surface of the ship $A_{,}'$, A_2', &c., on both sides of the plane $A_{,}$ C_3, &c., are equal. The plane $A_{,}$ C_3, &c. then divides the ship into two equal parts in the direction of its length, and perpendicularly to the water-line plane. The parallel sections, $A_{,}'$ A_3, $B_{,}'$ B_3, $C_{,}'$ C_3, &c., are called horizontal, and the parallel sections $A_{,}'$ $C_{,}$, A_2' C_2, A_3' C_3, are called vertical. Both the vertical and horizontal sections are drawn at equally distant intervals, their position and number being fixed at the discretion of the draughtsman; so that $A_{,}$ $A_2 = A_2$ A_3, &c., &c., and $A_{,}$ $B_{,} = B_{,}$ $C_{,}$, &c., &c.

The ordinate, $A_{,} A_{,}' = a_{,}$	$B_{,} B_{,}' = b_{,}$	$C_{,} C_{,}' = c_{,}$
$A_2 A_2' = a_2$	$B_2 B_2' = b_2$	$C_2 C_2' = c_2$
$A_3 A_3' = a_3$	$B_3 B_3' = b_3$	$C_3 C_3' = c_3$
&c. &c.	&c. &c.	&c. &c.

$$A_{,} A_2 = A_2 A_3 \text{ \&c.} = n$$
$$A_{,} B_{,} = B_{,} C_{,} \text{ \&c.} = m$$

(26.) The areas of the sections of a solid are summed to obtain its volume, exactly as the lengths of the ordinates of a plane curve are summed in order to obtain its area. And it can be shown, that the same volume is obtained by summing the vertical sections, as by summing the horizontal, when Simpson's rule is used.

Let H, H_2 and H_3 represent the areas of the three horizontal sections; then by Simpson's rule we shall have

$$H_{,} = \frac{n}{3}\left\{a_{,} + 4a_2 + a_3\right\}$$

$$H_2 = \frac{n}{3}\left\{b_{,} + 4\,b_2 + b_3\right\} \text{ See equation (1,) art. (20).}$$

$$H_3 = \frac{n}{3}\left\{c_{,} + 4\,c_2 + c_3\right\}$$

Put V to represent the volume $A_{,}$ C_3'

$$\therefore \quad V = \frac{m}{3}\left\{H_{,} + 4\ H_2 + H_3\right\}$$

$$= \frac{m}{3}\left\{\frac{n}{3}(a_{,} + 4\ a_2 + a_2) + \frac{4\,n}{3}(b_{,} + 4\,b_2 + b_3) + \frac{n}{3}(c_{,} + 4\,c_2 + c_3)\right\}$$

$$= \frac{n\,m}{9}\left\{a_{,} + 4a_2 + a_3 + 4b_{,} + 16b_2 + 4\,b_3 + c_{,} + 4\,c_2 + c_3\right\} \quad (1).$$

Again, let $V_{,}$, V_2, and V_3 represent the areas of the three vertical sections; then by Simpson's rule we have

$$V_{,} = \frac{m}{3}\left\{a_{,} + 4\ b_{,} + c_{,}\right\}$$

$$V_2 = \frac{m}{3}\left\{a_2 + 4\,b_2 + c_2\right\}$$

$$V_3 = \frac{m}{3}\left\{a_3 + 4\ b_3 + c_3\right\} \text{ See equation (1) art. (20).}$$

$$\text{But } V = \frac{n}{3}\left\{V_{,} + 4\,V_2 + V_3\right\}$$

$$= \frac{n}{3}\left\{\frac{m}{3}(a_{,} + 4\,b_{,} + c_{,}) + \frac{4m}{3}(a_2 + 4\,b_2 + c_2) + \frac{m}{3}(a_3 + 4\,b_3 + c_3)\right\}$$

$$= \frac{n\,m}{9}\left\{a_{,} + 4\,b_{,} + c_{,} + 4\,a_2 + 16\,b_2 + 4\,c_2 + a_3 + 4\,b_3 + c_3\right\}$$

$$= \frac{n\,m}{9}\left\{a_{,} + 4\,a_2 + a_3 + 4\,b_{,} + 16\,b_2 + 4\,b_3 + c_{,} + 4\,c_2 + c^3\right\} \quad (2).$$

Now, equations (1) and (2) are identical; therefore the same volume is obtained by summing the vertical sections as by summing the horizontal.

(27.) If the outer surface, $A_{,}'$ C_3' (see figure art. 25) be determined from the parabolic equation,

$z = A + Bx + Cx^2 + Dy + E\,y^2 + Fxy + Gx^2y + Hxy^2 + Ix^2y^2$ (a),'
where A, B, C, &c. are constant quantities, depending on the points $A_{,}'$, &c.; the volume included by this surface and the various planes in the figure will be the same as that obtained by Simpson's rule. The constants A, B, C, &c., must be determined by making the surface (a) pass through the nine points, $A_{,}''$, A_2', &c.; this will give the nine following equations, from which the values of A, B, C, &c. may be obtained by the ordinary methods of elimination.

$$a_{,} = A$$
$$a_2 - a_{,} = Bn + Cn^2$$
$$a_3 - a_{,} = 2Bn + 4\ Cn^2$$
$$b_{,} - a_{,} = Dm + Em^2$$
$$c_{,} - a_{,} = 2Dm + 4\ Em^2$$
$$b_2 - b_{,} + a_{,} - a_2 = Fnm + Gn^2m + Hnm^2 + In^2m^2$$
$$b_3 - b_{,} + a_{,} - a_3 = 2Fnm + 4\ Gn^2m + 2Hnm^2 + 4In^2m^2$$
$$c_2 - c_{,} + a_{,} - a_2 = 2Fnm + 2Gn^2m + 4Hnm^2 + 4In^2m^2$$
$$c_3 - c_{,} + a_{,} - a_3 = 4Fnm + 8Gn^2m + 8Hnm^2 + 16\ In^2m^2$$

From these nine equations the following values of A, B, C, &c. may be readily obtained.

$$A = a_{,}$$
$$2\ Bn = 4a_2 - 3a_{,} - a_3$$
$$2\ Cn^2 = a_{,} - 2a_2 + a_3$$
$$2\ Dm = 4b_{,} - 3a_{,} - c_{,}$$
$$2\ Em^2 = a_{,} - 2b_{,} + c_{,}$$
$$4\ Fnm = 9a_{,} - 12a_2 + 3a_3 - 12b_{,} + 16b_2 - 4b_3 + 3c_{,} - 4c_2 + c_3$$
$$4\ Gn^2m = -3a_{,} + 6a_2 - 3a_3 + 4b_{,} - 8b_2 + 4b_3 - c_{,} + 2c_2 - c_3$$
$$4\ Hnm^2 = -3a_{,} + 4a_2 - a_3 + 6b_{,} - 8b_2 + 2b_3 - 3c_{,} + 4c_2 - c_3$$
$$4\ In^2m^2 = a_{,} - 2a_2 + a_3 - 2b_{,} + 4b_2 - 2b_3 + c_{,} - 2c_2 + c_3$$

The volume of the elementary solid $A_{,}'$ C_3' will be represented by (see Gregory's Examples, p. 425),

$$\int_0^{2n}\int_0^{2m} z\,dx\,dy = \frac{mn}{9}\left\{36a_{,} + 36Bn + 48Cn^2 + 36Dm + 48Em^2 + 36Fnm + 48Gn^2m + 48Hnm^2 + 64\ In^2m^2\right\}$$

$$= \frac{mn}{9}\left\{a_{,} + 4a_2 + a_3 + 4b_{,} + 16b_2 + 4b_3 + c_{,} + 4c_2 + c_3\right\}$$

which is the same as equation (2), art. (26.) Therefore the usual mode of approximating to the volume of the solid of immersion leads exactly to the same result as that obtained by supposing the elementary surface passing through the nine points $A_{,}'$, A_2', &c. to coincide with the snrface whose equation is represented by equation (a).

SOCIETIES.

INSTITUTION OF MECHANICAL ENGINEERS.

22d October, 1851.

"*On the* Preservation of Timber by Creosote," by Mr. J. E. Clift, Birmingham.

In the present day, when the requirements for timber, in the varions mining, engineering, and other works, are so great, it becomes necessary to consider carefully the best means of rendering it as durable as possible, and that at the least expense; and the writer cannot think that sufficient attention has been paid to the subject by the parties most interested, from the fact that but few of the larger consumers of that article have adopted any plans for its preservation; and this fact must be the apology for bringing before the institution a paper upon a process which has been partially in use for several years.

In looking through the colliery districts, it is found that thousands of loads of timber are taken green from the forests, and used every year; and tbe greater portion is used in the pits, where, owing to damp atmosphere and increased temperature, it is rotted in a few months; whereas, with a small expense, it might be made to last for years.

It may be observed, also, that the railway engineers are seeking for a more durable bearing for the rails in iron sleepers, and overlooking the means of making wood, which is allowed to be the most agreeable for travelling upon, the most durable as well as the most economical material for the permanent way.

Wood may be briefly stated to be composed of a fibrous tissne, which, upon examination with the microscope, is found to consist of longitudinal tubes, arranged in concentric rings around the centre pith; these tubes varying in diameter from $\frac{1}{2000}$th to $\frac{1}{200}$th part of an inch. The use of these tubes in a growing tree is to convey the sap from the root to the branches; and after the tree is cut up for use they contain the chief constituent of the sap, vegetable albumen—a substance very much resembling in its composition animal albumen, or the white of an cgg. Different woods vary in the proportion which they contain of this substance; but in the softer woods it averages one per cent.

The dry rot in timber is caused by the putrefaction of the vegetable albnmen, to which change there is a great tendency; and when once this bas taken place, it soon infects the woody fibre, inducing decomposition, and causing its entire destruction.

Many plans have been proposed to arrest this evil, each with more or less success; the chief aim of the authors being to coagulate the albumen by

means of metallic salts, and so prevent putrefaction. Among others may be mentioned the following, as being the most successful:—Kyan's process, by the use of chloride of mercury; Burnett's by chloride of zinc; and Payne's, by sulphate of iron and muriate of lime, forming an insoluble precipitate in the pores of the wood. To each of these plans there are serious objections in practice. In the first place, when metallic salts are injected into timber in sufficient quantities to crystallize, the crystals force open the pores, causing a disruption of the fibre, and when the timber afterwards becomes wet they dissolve, leaving large spaces for the lodgment of water, and rendering the timber much weaker. Secondly, the metallic salts being incapable of sealing the pores of the wood, the fibre is still exposed to the action called eremacausis,—a process of oxidation, after the albumen has been precipitated. These processes are also objectionable for wood that requires iron inserted in or attached to it, as the acids act upon the iron in a manner well known, and ultimately destroy it.

The plan that is the subject of the present paper is the one invented by Mr. Bethell, for the use of a material obtained by the distillation of coal tar. This material consists of a series of bituminous oils, combined with a portion of creosote; this latter substance being acknowledged to possess the most powerful antiseptic properties. The action of this material may be thus described:—When injected into a piece of wood, the creosote coagulates the albumen, thus preventing the putrefactive decomposition, and the bituminous oils enter the whole of the capillary tubes, encasing the woody fibre as with a shield, and closing up the whole of the pores, so as entirely to exclude both water and air; and these bituminous oils being insoluble in water, and unaffected by air, renders the process applicable to any situation. So little is this oil affected by atmospheric change, that the writer has seen wrought-iron pipes that had merely been painted over with it, and laid in a light ground one foot beneath the surface, taken up after twenty years, and they appeared and smelt then as fresh as when first laid down.

By using these bituminous oils, the most inferior timber, and that which would otherwise soonest decay, from being more porous and containing more sap, or being cut too young or at the wrong season, is rendered the most durable. This will be readily understood, when it is considered that this porous wood will absorb a larger portion of the preserving material than the more close and hard woods: in fact, the soft woods are rendered hard by this process. By this means, therefore, engineers will be enabled to use a cheaper timber with greater advantage than they could use a more expensive timber uncreosoted; — thus, taking the cost of a sleeper of American yellow pine at 4s., and one of Scotch fir at 3s., and then adding 1s. to the latter for creosoting, the two would be the same cost; but the former one would last, under the most favourable circumstances, not more than ten or twelve years, and the other would be good under any circumstances, in all probability, in a hundred years.

This system of preserving timber has been in use on several railways, and other works, for several years past. A portion of the London and North Western Railway, about seventeen miles in length, has been laid with the creosoted sleepers from nine to eleven years, during which period the engineer reports that no instance has occurred in which any decay has been detected in them, and they continue quite as sound as when first put down. On the Stockton and Darlington Railway, creosoted sleepers have also been laid for ten years, and are found to continue without any appearance of change or decay; also on the Lancashire and Yorkshire Railway creosoted timber has been used for five years, as paving blocks, posts, &c.: the upper part becomes very hard, and the part under ground appears as fresh as when taken out of the creosote tank, though the timber was of inferior, sappy quality. In a trial commenced twelve years since, by Mr. Price of Gloucester, of the comparative durability of timber in the covers of a melon-pit, where it was exposed constantly to the combined action of decomposing matter and the atmosphere, the unprepared timber became decayed in one year, and required replacing in a few years. A portion of the timber that had been kyanised lasted well for about seven years, but then gradually, though very slowly, became quite decayed; but the timber that had been creosoted still continues as sound as when first put down, twelve years since.

From these facts, it appears not unreasonable to infer, that if timber be made to continue unchanged, and to show no symptom of decay for ten or twelve years, under circumstances that reduce unprepared timber to dust in two years, in the absence of any proof to the contrary we may expect to find that it will last an unlimited period, and that one hundred years will be a moderate life to assign to it.

And not only does this creosoting process render wood free from decay, but it also preserves it from the attacks of the teredo worm, when used for ship-building, harbours, docks, and other work contiguous to the sea.

This has been satisfactorily proved at Lowestoft harbour, where the plan has had a very extensive trial for four years ; and the superintendent reports that there is no instance whatever of an uncreosoted pile being sound ; they are all attacked by the limnoria and the teredo to a very great extent, and the piles in some instances are eaten through ; but there is no instance whatever of a creosoted pile being touched, either by the teredo or the limnoria, and all the creosoted piles are quite sound, though covered with vegetation, which generally attracts the teredo. This extraordinary fact is to be accounted for by the creosote remaining intact in the timber, either wet or dry ; and, being destructive to all animal life, is proof against the attack of these parasites ; whereas, with the other processes, the metallic salts are washed out, or that portion which unites with and coagulates the albumen is rendered quite innocuous by the process. It will be seen, by the specimens exhibited, that the ravages of the worm reduce the unprepared timber to a completely honeycombed state in two years; but the creosoted timber remains untouched after a period of four years.

There are two processes in use by Mr. Bethell, for impregnating timber with creosote;—one is by placing the wood in a strong iron cylinder, and exhausting the air from it by an air-pump, until a vacuum is created, equal to about twelve pounds on the square inch. The creosote is then allowed to flow into the cylinder, and afterwards a pressure is put upon the creosote by a force pump, equal to about 150 pounds on the square inch; the timber then taken out is fit for use.

The second process is by placing the timber in a drying-house, and passing the products of combustion through it ; thereby not only drying the timber rapidly, but impregnating it, to a certain extent, with the volatile oily matter and creosote contained in the products given off from the fuel used to heat the house. When the timber is taken out of this house, it is at once immersed in hot creosote in an open tank, thus avoiding the use of a steam-engine, or pumps.

Mr. Clift exhibited specimens of Creosoted Sleepers, which had been in use for ten years on the London and North Western Railway, near Manchester, and were still perfectly sound and unchanged; also specimens of Creosoted Piles from Lowestoft Harbour, which had been in the sea for four years, and continued quite fresh and sound, and without being touched by the worm; with specimens of similar piles, uncreosoted, from the same situation, which were completely eaten away and honeycombed by the worm in the same period.

Mr. Bethell observed, that when he first commenced to preserve timber, he found that no pressure would get the creosote into the timber from the presence of moisture in the pores, and it became necessary to adopt the system of drying the timber first; and after fourteen days he found that the wood lost 3 lbs. in weight in every cubic foot; this was by the old process of drying. He then introduced the present drying-house, and in twelve or fourteen hours they lost 8 lbs. per cubic foot, in Scotch sleepers, and these then absorbed an equal weight of creosote. An average of 11½ lbs. of creosote per cubic foot was now put into all the Memel timber at Leith harbour works ; it was forced in with a pressure of 180 lbs. per inch. One piece of creosoted timber had been observed at Lowestoft, which had been half cut through for a mortice, but not filled up again, and a teredo had penetrated a little way into it at that part, and then attempted to turn to the right, and then to the left, and had ultimately quitted the timber without proceeding any farther. Young wood was the most porous round the exterior, and consequently absorbed most creosote, which formed a shield to keep off the worm. The creosoted sleepers were better after eight or ten years than when new, because the creosote got consolidated in them, and rendered them harder. He had taken the idea originally from the Egyptian mummy; it was exactly the same process ; any animal put into a creosote

tank assumed the appearance and became in like condition to a mummy. Timber creosoted was now chiefly used in railways; but he believed that if it was introduced into coal-pits it would be found that no timber so used in those places would rot.

The Chairman remarked, that if the owners of pits found it so much to their advantage, he was sure the plan would come into use.

Mr. Clift said he had taken up the subject in the present paper with that view; his object was to draw attention to pit timber, and he was satisfied that if the timber used in coal-pits was creosoted, it might, when done with in one situation, he again taken out to use in another place; whereas now, because the dry rot seized the timber so quickly, it was left behind in the workings of the pit.

The Chairman enquired whether, in the process of creosoting, the quantity of sap extracted was calculated, and bow the exact quantity of creosote that was put into the timber was ascertained?

Mr. Bethell replied, that every piece of timber was weighed before it was put into the creosote tank, and again when taken out, and each piece was required to be increased in weight by the process 10 lbs. per cubic foot; the quantity of oil used always rather exceeded the weight gained in the timber, on account of the loss of weight from the moisture extracted by the exhaustion of the air-pump.

The Chairman inquired what difference was found in the quantity of creosote absorbed by the harder woods?

Mr. Bethell replied, that oak only absorbed half as much creosote as Memel timber. Common fir creosoted would last double the time of hard wood creosoted, because it took more creosote. Beech made the best wood, being full of very minute pores, and they could force a greater quantity of creosote into beech than into any other wood; consequently it took a more uniform colour throughout from the process.

Mr. Shipton inquired how the process was regulated to allow for the difference in size of timber?

Mr. Bethell said that long pieces of timber were found to require more time to saturate them in proportion to their length, and the creosote appeared to enter at the two ends, and be forced up through the whole length of the pores. The progress was known by the quantity of creosote forced into the tank after it was filled, according to number of cubic feet of timber contained in the tank.

INSTITUTION OF CIVIL ENGINEERS.

December 9, 1851.

The paper read was "An Account of the Works on the Birmingham Extension, of the Birmingham and Oxford Junction Railway," by Mr. C. B. Lane, Assoc. Inst. C.E.

The act for this line, which was intended to form the connecting link between the Birmingham and Oxford, and the Birmingham, Wolverhampton, and Dudley Railways, and so complete the broad gauge circuit with Bristol and the south-west of England, was passed in the month of July, 1846. Subsequent events, however, caused the suspension of these works in 1849, before their final completion. The line commenced near the Coventry road, and was to have terminated at Great Charles-street. From Adderley-street to Park-street, both inclusive, the town was crossed by a viaduct; and from Moor-street to Monmouth-street, the line passed under the highest of the eminences on which Birmingham stands, by means of a tunnel, which was to have been constructed as a covered way, that is, by opening the ground, putting in the brick-work, and again covering up ; and the part of it as yet completed, from Moor-street to High-street, being about 142 yards in length, was executed in this manner. It was 27 feet in width at the level of the rails, and was built entirely of Staffordshire brick set in mortar, with the exception of the arch lengths through Carr's-lane, which were set in cement. The average rate of progress in the tunnel was 8.1 lineal yards per week.

The viaduct consisted of fifty-seven openings, composed of nine segments, each 30 feet span and 6 feet rise, fifteen semicircles also 30 feet span and 15 feet rise, twenty-seven semi-ellipses, each 15 feet rise, and varying in span from 37 feet to 48 feet, and six street bridges, mostly skew, and varying in form, span, and rise. Its total length was 930 yards, general width, from face to face, 31 feet 7½ inches, and between the parapets at the level of the rails 29 feet. It was built entirely of brick-work set in mortar, with the exception of the soffit of the bridge over Park-street, which was constructed of cast-iron girders, with a cross-transomed memel flooring. The red brick of the district was used throughout the footings, the internal work of the piers, and the spandril walls; the arches and parapets were constructed of Staffordshire brick, from the "common stock"—the copings, mouldings, and dentals being made of Staffordshire brick clay; and the whole of the work was faced with Staffordshire "best blue." All the brick-work was set in moist mortar, so as to press to a thin joint, and in hot weather the bricks were kept constantly wet. The mortar used in the work was composed of the red sand of the locality, and Dudley, or Greaves' blue lias lime—the latter being used in all foundations, arches, and face work—mixed in the proportions of one part of slaked lime to two parts of sand, and worked by a steam mill, driven by a four-horse power engine, made by Mr. Nathan Gough; Assoc. Inst. C.E., of Manchester. This mill was capable of supplying fifty bricklayers per day, with a mortar of a perfectly even texture, entirely free from lumps, and therefore less likely to become vesicular, from the trans-filtration of water, than that mixed by the common pug-mill. Each set of centres consisted of five ribs, each rib being supported on two vertical and two sloping props, the former under the heels of the ribs, and the latter under the points where the struts of the ribs terminated in an iron shoe. The laggings used were 3 inch deals, carefully dressed by the adze to the proper curves, and lined for the courses of the skew arches. Corbels of heading bricks were carried out from the backs of the arches in the range of the spandril walls, of equal width with them, and connected by brick beams from arch to arch, for stiffening and equalizing the pressure from end to end of the viaduct, and the useful effect of this mode of construction was proved by the comparatively small amount of the settlements of the arches.

The various modes adopted, and mechanical contrivances used, for raising the materials to a considerable height, were described; and deductions were drawn from a very numerous series of experiments, to ascertain the values of the useful effect produced by the "Labouring Force" (Whewell), or "Travail Méchanique" (Poncelet), of a man under different modes of its application, and also for a horse under alternating motion over a short space. From these it appeared, that the relative costs of raising the materials to a height of 46 feet, by the horse-lift, the swing-lift, and the box-lift, were 3.08, 5.90, and 4.13 pence per ton respectively, showing a saving in favour of the horse-lift against the swing-lift, of nearly threepence per ton, and against the box-lift of rather above one penny per ton.

The communication was accompanied by a most elaborate series of tables on the absorption of water by bricks, by mortar, and by Shrewley sandstone —of the settlements of the arches of the street bridges—of the work performed by the various lifts, under different circumstances, with the concurrent particulars, and that by ordinary hod-men.

December 16, 1851.

The paper read was "On the Alluvial Formations and the Local Changes of the South-eastern Coast of England: first Section, from the River Thames to Beachy Head," by Mr. J. B. Redman, M. Inst. C. E.

The paper stated, that the passage of shingle along the English coast, due, as was generally believed, to the action of waves alone, took, on the south coast, a course from west to east, and, on the east coast, from north to south; during certain winds the shingle was heaped up coincident with their direction, and repeated withdrawals and renewals (the latter being the most frequent), caused a leeward movement of the material, forming it, at the same time, into a series of triangles, of which the shore was the base. If any natural projection intercepted this motion, an accumulation, which would increase and be held in check, according to the state of the wind, took place up to a certain point, or until the angle formed was filled up, when the shingle passed round. With groynes, by far the most common action was, unless they were of great height, or short length, for the shingle, after accumulating on the weather side to the level of the top of the groyne, to pass over it, and then travel to leeward.

The degradation of the north shore of Kent, the local formation of shingle

around the Isle of Thanet, by the wasting away of that chalky promontory, and the retention of large masses of alluvial matter in Pegwell Bay, were dwelt on. The main belt of shingle lying to the south of Deal, and extending from thence to Dover, with its early and present effects on the harbour at the latter place, were then described; also the early condition of Folkestone Harbour, the large accumulation of shingle arresting to the westward of that haven, by the projection of a low-water pier, or groyne, at right angles to the harbour, and its effects upon the shore to the eastward, by retarding the the progressive motion of the shingle in that direction. Further on, the curious formation of Dungeness Point, which it was reasonable to suppose did not, at one time, exist; as the parallel "fulls" of beach between Romney and Lydd, and extending from Winchelsea on the west to Hythe on the east, seemed fairly to have constituted the sea coast. The rectangular "full," running from the banks on the west side of Lydd towards the point might have been created by an accumulation of shingle travelling from the westward, held in check by the outfall of the river Rother; the angle contained by this spit and the coast to the westward becoming gradually filled up with shingle, a silty deposit would take place on the east side, consequent on the gradual loss of Romney harbour, and the length of the spit would be increased by the parallel ridges of shingle periodically added to and travelling round it. Numerous examples, extending over two centuries, showed that the average annual increase was six yards, reaching, over certain periods, an average of eight yards per annum—the absolute increase since the time of Elizabeth being nearly one mile; and they proved conclusively, that the average progress seaward, producing a determinate aggregate elongation in a south-easterly direction, was much greater than had been generally assumed, though not regular, for the Ness had even been stationary during certain periods.

The gradual decadence of the ancient ports of Hythe, Romney, and Lydd to leeward of this Point, were then alluded to; as also the diversion of the outfall of the river Rother to Rye, once an estuary of the sea, and then forming Romney Harbour; the great increase of shingle to the westward; the early and abortive attempts to form a harbour at Hastings; the vast abrasion of the coast along Pevensey Bay, the harbour of which place had been lost by an elongation and extension of Langley Point. Between the origin of this Point and that of Dungeness, there was a remarkable similarity, both having originally had a tidal haven to the leeward, eventually choked up by the elongation of these spits across their outfalls; both had pools, or meres, arising from the land-locked waters, and in both cases the modern "fulls" of shingle could be plainly distinguished from the more ancient, by their forms and direction. The remarkable decrease of this point, about three-eighths of a mile, during the last century, appeared to rise principally from Old Brighton Beach no longer affording the necessary supply of shingle.

The early condition and present state of Cuckmere and Newhaven Harbours, the great degradation of the coast at Rottingdean, the sweeping away, in Elizabeth's reign, of the beach and town of Old Brighton, then standing on the site of the present chain-pier, the materials from which formed the spits to the eastward, were then described.

The author had personally inspected the whole of this coast, the different sections of which he promised to give in succession, and had also examined the earliest accessible maps, and the works of the best topographical writers, who were frequently referred to, in elucidation of the subject, which was one of vast importance in marine engineering, especially in reference to the construction of harbours and coast works of defence; and he submitted that it was most desirable that such natural agencies, and the many instances of the compensating effects of alternating loss and gain, should be correctly understood.

PROCEEDINGS OF THE ROYAL SCOTTISH SOCIETY OF ARTS.

December 8, 1851.

The following communications were made:—

1. Description and drawing of public baths and wash-houses established at Hawick. By John Goodfellow, Buccleuch-street, Hawick.

The commencement of the wash-houses, on the present plan, was in 1847, and with three compartments. In the spring of the year 1850 the author had twenty-four washing compartments in operation—each compartment holding three tubs, or seventy-two tubs in all. One of the tubs in each stall is made a boiler, with a lid; and, by having a steam-pipe dipping into it, the supply of water—cold and hot—is without limit; as also is the steam for boiling the clothes. The charge for each washer is one penny per hour. In the course of the first year, from April 1850 to April 1851, upwards of 25,000 washers made use of the public wash-houses—a number equal to three times the entire population of the town of Hawick. The baths were erected in the autumn of 1850, and during the summer months, and in warm weather especially, are well patronized. In winter the demand for baths falls off, and, consequently, they are only open on Saturdays. The charges are a penny for a warm shower-bath, and twopence for a warm bath—second class; first class warm bath, sixpence; with use of clean towels in both. The baths are twelve in number, with shower-bath in each. To the boiler is attached a small steam-engine, which pumps water from a sunk well on the premises for the baths and wash-houses; while the steam, after doing this duty, is conducted away in covered pipes, and heats the water for the baths and washers, and also boils the clothes being washed. Similar establishments may be erected in every town in Scotland, where coals are moderate in price, and water to be had at no great depth below the surface —being thus independent of any water company or corporation.

2. Description and drawing of a self-acting railway signal. By Mr. John G. Winton, Cherry Bank, North Leith.

The object of a signal of this description is to show, to the engine-driver of a following train, the time when, or distance at which, a preceding train has passed along the line, so as to caution him in passing through a tunnel rounding a curve, or any place that may be considered necessary. The time signal is effected by means of a cataract, with catches, palls, &c. (such as are in use for regulating the strokes of large pumping engines), wrought by the engine on passing, which also raises the signal board. The arrangement is such that the danger signal remains for five minutes, the caution for other five minutes, when it shows all clear. The distance signal, instead of having a cataract, has a wire rope connected with the palls, which passes along the line to a certain distance, where it is fixed to a lever, which the engine, on passing, depresses and sets off the signal at one or more of the stages, as may be considered best.

3. Suggestions for the improved manufacture of sheet iron. By Mr. John Waters, mill-wright and engine-builder, Macon.

Mr. Waters conceives the following plan will accomplish the object, and he requests the Society to endeavour to get it tried, viz., to have a pair of rolls, say 26 inches diameter, working horizontally one in front of the other, and set in a cast-iron frame as strong as is generally used in rolling iron. The rolls being perfectly true, let a groove be turned out of both ends of each roll, so that a plate can be fitted nicely to each roll. These plates will form a receiver on the top of the rolls, with a chance of allowing the waste or cinder to get away. Let the iron be run from an air-furnace, at that stage of heat when the iron is properly melted and in a fine liquid state, into the receiver on the top of the rolls. Working downwards, a thin skin will be formed on each roll, which will vary in thickness according to the temperature of the rolls, and will weld together at their junction, which will form a continued length of sheet-iron without scale, and of the purest quality. The sheet can never exceed one 3-32ds of an inch in thickness. Let there also be a cast-iron pan underneath the rolls, two-thirds of their radius, covered with water, so that the rolls may be kept at a proper temperature by a constant stream of water being made to run into the pan.

4. Description of an improved jointed artificial leg for short stumps. By Mr. John Howell, Polyartist, 110, Rose-street, Edinburgh.

The seat or top of the artificial leg is attached to the buttock, and plays outwards, to enable the wearer to sit on his breech by means of the hip joint. In the action of sitting down, a slip bolt is drawn, which enables the knee-joint to play, so that the lower part of the limb and foot takes the natural position; and, in rising up, the bolt by that action again enters the knee-joint, whereby the limb becomes rigid, and fit for supporting the body, and for walking. The full-sized limb has been made for a person of fourteen stone weight, and, as worn, weighs only six and a quarter pounds.

PROCEEDINGS OF THE GEOLOGICAL SOCIETY.

December 3rd, 1851.

W. Hopkins, Esq., in the chair.

Mr. Bunbury, foreign secretary, read a paper on a new plant discovered in the coal field of Cape Breton, and presented to him by Mr. Brown, a resident in the neighbourhood. The plant possessed characters which rendered it difficult to distinguish whether it belonged to the ferns or to the Lycopodiaceæ; and it was stated that the plant was new to the coal fields of this country. The paper contained numerous botanical details, which it would be impossible to condense into a small space.

Sir Charles Lyell stated that this plant, which he had also examined, was from a coal field where an abundance of plants were found growing upright, and he trusted that, through the exertions of Mr. Brown, the Society would shortly be in possession of some of those interesting forms, which would serve to throw much light on the history of the coal plants.

The next paper was by Professor Sedgwick, on a remarkable district of Westmoreland and part of Yorkshire, intersected by the two great faults, termed the Penine and the Craven faults. Numerous sections, in the neighbourhood of Kirkby Stephen, Brough, Houghhill Fells, &c., were referred to in illustration of the paper. The carboniferous limestone and the scar limestone, which forms the base of the carboniferous system in this part of England, had been much shattered by the great faults alluded to. The old red sandstone, below the scar limestone, is very feebly represented; but there is a considerable development of Silurian rocks occupying the country to the south-west of Ravenstone Dale. Professor Sedgwick appears to identify these rocks with the Coniston flags and limestone. With reference to the flaggy beds which furnish slates for roofing purposes in this part of the country, the Professor said the slates were not split in the lines of cleavage, as was usually the case, but were raised from their natural beds, and split into laminæ parallel with those beds. Other beds of stone, locally termed *calliards*, were raised in the same neighbourhood as the slates. The Professor described the occurrence of a remarkably thick mass of sandstone, stratified in the middle of the carboniferous limestone, or rather between the upper and lower limestones. The beds of sandstone bore a remarkable resemblance to those of the new red sandstone, were frequently quite red in colour, and presented that variegated and blotchy appearance so characteristic of the new red sandstone in Cheshire. Professor Sedgwick alluded to the occurrence of immense blocks of grit stone on the top of Houghhill, and said that similar transported blocks of limestone were met with in some parts of the district. These blocks have been carried across deep valleys at a comparatively recent period; they are covered with lichens, ring with a clear sound on being struck with a hammer, and present no signs of disintegration. He also noticed a remarkable distinction between the two great faults of this district, namely, that the Penine fault took place after the deposit of the magnesian limestone and several other beds of the Permian series, as these are found resting conformably on the inclined beds of carboniferous limestone in the neighbourhood of that fault, whereas the Craven fault took place before the deposit of the Permian beds, which is evident from the fact, that these beds rest horizontally on the inclined strata of carboniferous limestone.

Sir Roderick Murchison, in paying some well-deserved compliments to Professor Sedgwick, seemed to think that the flags and limestone beds containing Silurian fossils, and supposed by the Professor to be identical with the Coniston beds, were higher in the Silurian series than the place assigned to them by the Professor. Some of the fossils in these beds were commonly found in the Wenlock limestone.

Professor Forbes, in reference to remarks by the author of the paper on the subject of tracks of Annelides and other markings on sandstone slabs, said that these were common to sandstones of many different ages, and that specimens existed in the Museum of Economic Geology, where not only markings of animals resembling Annelides were seen, but also lines of short dashes, such as would be made by the fins of fishes striking the sand. He also referred to the existence of sandstone beds in the limestone at Alston, of a similar character to that described by Professor Sedgwick.

After a few unimportant remarks by other gentlemen, the President, in observing how gratifying it was to the Society to see Professor Sedgwick resuming his labours in so zealous a manner, took occasion to repudiate the idea that the transported blocks of stone spoken of by the Professor had been carried either by currents of water or by glaciers. He thought they were undoubtedly due to floating ice.

AGRICULTURAL ENGINEERING AND CONSTRUCTION.

ON THE CONSTRUCTION OF THE CATTLE LAIRS.*

The change of fiscal regulations as to the importation of foreign agricultural produce, which has taken place within the last few years, will render every improvement in agriculture in Britain of increased importance; and to those more immediately interested in the pursuit, no branch of rural economy can be of more consequence than the means for the economical management of cattle. The generally imperfect management of fattening stock, and the negligent preparation of manures, so prevalent in times past, cannot enable the husbandmen of Britain to meet, without diminution of capital, the unrestricted competition of foreigners in the British market in every kind of produce of the soil, which he now has, and it is probable he will have to encounter. The excrements of a few half-fed wintering cattle and the litter of an open yard, exposed to the alternate influence of rain, wind, and sunshine, will do little towards raising such grain crops as will encourage the British farmer in the employment of his capital and of native industry in the cultivation of the soil; nor will the estate of the proprietor of land be supported in its value in the absence of accommodation for the fattening of stock with the greatest economy, and of convenience for the collection and conservation of manure, without waste of its fertilizing properties.

The importance of conveniences for fattening stock is not at all a matter of controversy; but on the best mode for obtaining that end considerable difference of opinion as yet exists. Some advocate the confining of the animals singly in *loose boxes;* others prefer tying them up in *stalls;* whilst many consider the *fold-yard* and hovel the best and most economical mode by which the object in question can be attained. On a careful examination of the merits of the question in all its bearings, it will be found, however, that each of the modes referred to has its superiority under different circumstances.

The conditions, on which the fattening of cattle can be attained with the greatest economy, are warmth, quietude, wholesomeness of atmosphere, and cleanliness.

In the plan of feeding fattening cattle singly in boxes or loose stalls, first suggested by Mr. John Warnes, of Trimington, in Norfolk, the conditions for the rapid and economical conversion of the inedible vegetable productions of the field into food for mankind, through the medium of their consumption by cattle, are in every respect perfectly fulfilled. By the plan now being discussed, warmth and shelter are provided without the rigid restraint of the stall, while at the same time much of the freedom of the yard and companionship—enjoyments so consonant to the natural habits of gregarious animals—are secured without the possibility of molestation or injury. From the constant trampling of beasts kept in boxes, their excrements mixed with their litter become so much compressed as to be impervious to air; and the contents of the boxes being thus deprived of an essential agent in producing putrefaction, no sensible exhalation of effluvia takes place. A daily supply of as much dry litter as will keep the animals clean of their solid excrements is sufficient to absorb the whole of the urine they void; and where economy in the use of straw may be an object, its being cut into lengths of about an inch considerably increases its power of absorption. As to the latter observation, respecting the absorption of moisture, it may be stated that, before having had an opportunity of ascertaining the fact, the writer was of opinion that super-saturation of an inordinate quantity of litter with urine would take place; but three years' experience in the matter has induced a thorough conviction that less straw is required to keep cattle clean and comfortable in boxes than in any other mode of confinement. In recommending the box system as an excellent mode of

* From a "*Treatise on Agricultural Buildings,*" by John Ewart, land surveyor. London: Longman and Co.

sheltering cattle whilst in a fattening state, whatever may be supposed by those who may not have had an opportunity of watching the box feeding system in operation, the writer can bear positive testimony to its being consistent with perfect cleanliness and perfect health of the beasts. He moreover firmly believes that whenever any objection has been raised to the system, as to its being either uncleanly or unhealthy, such objection has been induced by having seen boxes of improper construction and fitting, or perhaps from excess of moisture from rain above or from springs beneath.

Besides the efficiency of cattle boxes in their chief purpose, a secondary, but scarcely less important object, is attained by their use, and that is the raising of manure much superior in quality to any of a similar description produced by any other means.

So far from the use of boxes being necessarily accompanied with any extraordinary labour or expense in attendance on the animals, the writer can state, from personal knowledge, that in boxes well arranged with a view to economy of time and labour, a boy under fifteen years of age, at wages of 5s. a week, prepared and served the whole of the food, consisting of chaff, softened by steam, mixed with linseed jelly, and barley-meal, and raw turnips sliced, in alternate feeds, five or six times a day, to twenty-two fattening beasts (seventeen of which were fed in boxes and five in stalls). The boy, moreover, thoroughly dressed every beast with curry-comb and brush; all this, too, without being so fully employed as not to have spare time to attend to swine, and do other usual jobs in the vicinity of his principal charge.

A box of about 80 square feet clear of area, and 2 feet deep, will contain the manure produced by a beast, having a sufficient supply of litter to keep it clean and dry, from the commencment of November to the end of February; and by increasing the depth an additional foot, it will hold the manure produced till the end of April. If 80 square feet for the clear area of a box is sufficient for a beast of the largest size, the dimensions may be varied from 9 to 11 feet from back to front, by frontage breadth varying from 9 to 7 feet, as may be best adapted to the site on which a given number of boxes are required to be built. The depth should never exceed 3 feet, as beyond that depth it would be inconvenient and not altogether unattended with danger to the animals in getting them in and out until a considerable quantity of manure had accumulated in the boxes.

For this particular purpose of fattening, tying cattle up in stalls is undoubtedly less efficacious than keeping them singly in boxes of proper arrangement and construction. This inferiority is chiefly on account of the confinement being too rigid, and of incurring the labour consequent on the frequent removal of the dung. For milk cows, however, they being usually allowed moderate exercise during a portion of the day, stalls appear generally to be as well adapted as boxes, with the particular advantages of stalls over boxes in the more ready access to the animals for the purpose of milking, and of requiring much less space for the same number of cattle.

The boxes should be sunk one foot below the level of the surface of the ground, and be separated from each other by a wall one brick thick and two feet high from their bottom or floor. They should also have a similar wall in front; upon both of which there should be a wall plate of deal, nine inches wide and three inches thick, bringing the entire height of the division walls to two feet three inches above the level of the floors, and that of the front to one foot three inches above the level of the passages. All the intersections of the front wall of the boxes by the divison walls, should be cast-iron pillars, 6 feet long and 4½ inches outside diameter, supporting a deal, similar to the wall plates described, to carry the roof; and at each end of the range of boxes should be an upright jamb of 9-inch deal, laid flat to the inside of the north wall, and to the north side of the party wall, between the range of boxes and the calf house, such jambs being framed to the wall plate, and the deal supported by the pillars. The cast-iron pillars should have grooves formed on each of their sides, in the direction of the length of the range, and also another groove on the side in the direction of the division walls between the boxes, the grooves being formed of flanges, 2½ inches apart and 2 inches deep. The upright deals against the walls at the ends of the range of boxes, should have half the breadth of a Norway batten nailed firmly on the face, at 2½ inches apart, thus forming a groove in the middle of the breadth of the deals throughout their length, 2½ inches wide and 2½ inches deep. On the deal supporting the front of the roof, and immediately above each cast-iron pillar, should be firmly spiked one end of a Norway batten, which should extend across the range of boxes to the back or west wall, on which it should rest firmly, spiked to template, or a continuous wall plate of deal, 4½ inches wide. Against the back or western wall of the boxes should be upright deals, framed to the wall plates on the division walls between the boxes, and receiving the cross beam spoken of above in a notch. The upright deal just mentioned should have a groove formed on its face, similar to those previously described on the upright deals at each end of the range, at the front of the boxes. Midway in the length of the divisions between the boxes should be two upright pieces, half the breadth of a Norway batten, opposite to each other, at 2½ inches apart, the lower ends of which should be framed to the wall plate on the division walls, between the boxes and the upper end, secured to the cross beam by a screw bolt. The fronts of the boxes should be enclosed to the height of about 4 feet above the walls; first by an 11-inch deal, and then by Norway battens in succession, one above another, fitting rather loosely in the grooves on the sides of the pillars, in the direction of the length of the range. The fences between the boxes may be formed also of battens, one end of which being fitted into the groove on the pillar in the direction of the breadth of the boxes, the other in the groove formed upon the upright deal on the back wall, passing between the half-battens at the mid-length of the division walls, and should be held one foot apart from each other by cotterill bolts, in holes made for the purpose in the flanges of the grooves. When the excavations of the boxes are in sound clay, and impervious to liquid, all that will be required to be done to the bottom is to beat it firm; but if the soil be loose and impermeable in which the boxes are made, it will be necessary to cover their bottoms with concrete, described in the appendix; or perhaps in some cases it may be necessary to line them with bricks laid in cement, in order to prevent the escape of the liquid; and in all cases before being used, the outside of the walls should from their foundations be carefully cleared of brickbats and rubbish let fall by the bricklayers, and well puddled below the surface of the ground. Such precautions are essentially necessary to perfection in the construction of the boxes, as escape of liquid would cause a great deterioration of the fertilizing quality of the manure.

It is a well-ascertained fact, that young cattle, from the time of their being weaned, until they have advanced towards their full stature—which, in the breeds most distinguised for precocity, is not until they have completed the second year of their age—require freedom and exercise to attain the necessary growth of frame, to fatten at an after period to the greatest advantage. To confine and attempt to fatten oxen by forced feeding previous to their having nearly attained their full growth, is apt to stop the development of frame necessary to carry a great thickness of flesh; if such treatment be not even productive of absolute disease, from the shock the constitution of the animal is exposed to, by so violent an opposition to nature. The aim of the prudent rearer of cattle is to promote in his stock a continually progressive increase of frame and muscle, without acquiring fat. To attain this object, the animals require at all times a plentiful supply of provender, of good but not too nutritive quality; considerable extent of freedom; and in winter perfect, but not in any degree heating shelter. These conditions will be best fulfilled by means of fold yards provided with sheds.

DIMENSIONS OF STEAMERS BUILDING IN BALTIMORE, UNITED STATES.

1. *Palmetto*, Propeller.—The first of a line of steamers to be established between Baltimore and Charleston, S. C. Builder, J. A. Robb; engines by C. Reeder, jun.

Length on deck	186 feet
" of keel	172 "
" between perpendiculars	175 "
Breadth of beam	30 "
Depth of hold	18 "
Dead rise..	10 inches
Tonnage (custom house measurement)	750 tons

Immersed sectional area at load line, or direct resistance, 224 square feet.

Two direct action engines, with vertical cylinders.

Diameter of cylinders	44 inches
Stroke of pistons..	40 "
Diameter of air pump	28 "
Stroke of air pump piston ..	20 "

Slide valves—Steam ports, 4 × 20; exhaust ditto 4 × 20.

Two cylindrical iron boilers, with double return flues. Length, 16 feet; diameter, 9½ feet. Fuel, bituminous coal.

One cast iron propeller. Diameter, 11½ feet; face, 40 inches; pitch, 23½ feet. Propeller surface, 98 square feet; being a proportion of propelling surface to area of direct resistance as 1 to 2·28. Length of propeller shaft (3 sections), 72 feet; diameter of ditto, 10 inches; journals of ditto, 10 × by 12 inches.

The *Palmetto* is a fine looking vessel, with excellent lines of flotation. Three masted, schooner rigged, with foresail, foretopsail, and foretopgallantsail.

2. *General McDonald.*—For the Philadelphia line, to run in connexion with the *Robert Morris* on the Delaware. Builder, J. S. Brown; engine re-built by C. Reeder, jun.

Length on deck	225 feet
Breadth of beam..	30 "
Over guards	54 "
Depth of hold	9 "

Draft of water	$4\frac{3}{4}$ „

Hollow lines, coppered and copper fastened.

One beam engine, re-built, having been in use for several years on board the late steamer *Constitution.*

Diameter of cylinder	52 inches
Stroke of piston	10 feet
Diameter of air pump	40 inches
Stroke of air pump piston	44 inches

Two iron boilers, arch and tubular. Fire and flue surface, about 3,000 square feet; fuel, wood.

Length of boilers	$17\frac{1}{2}$ feet
Breadth	9 „
Height in front	10 „
„ at back	$8\frac{1}{2}$ „
Diameter of flues (internal) ..	3 inches
Diameter of water wheels ..	31 feet
Face „ „ ..	$8\frac{1}{2}$ „
Depth of buckets	30 inches
Diameter of water wheel shaft, (wrought iron)	13 „

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3. A side wheel steamer for Savannah, Georgia. R. and E. J. Bell, builders; engine, by C. Reeder, junior.

Length on deck	130 feet
Breadth of beam	20 „
„ over guards	34 „
Depth of hold	$7\frac{1}{2}$ „

One beam engine.

Diameter of cylinder	24 inches.
Stroke of piston	8 feet
Diameter of air pump	18 inches
Stroke of air pump piston ..	42 „

One cylindrical iron boiler.

Length of boiler	$15\frac{1}{2}$ feet
Diameter	$7\frac{1}{2}$ „

Double return flues, fire and flue surface, 800 square feet; fuel, wood.

Diameter of water wheel	22 feet
Face of „ „	5 „
Depth of bucket	20 inches
Diameter of shafts (wrought iron)	7 „

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4. A side wheel steamer for La Guayra, South America. Builder, —— Gardner; engines by Murry and Hazlehurst, Vulcan Works.

Length on deck	132 feet
„ between perpendiculars ..	130 „
Breadth of beam	21 „
„ over guards	34 „
Depth of hold	9 „
Tonnage (custom-house measurement)	250 tons

Has a drop deck and is a three masted schooner rigged. Is supplied with two steeple engines connected.

Diameter of cylinders	28 inches
Stroke of piston	48 „

One double acting air pump, worked from crank motion of centre shaft.

Diameter of air pump	$18\frac{5}{8}$ inches
Stroke of „ piston ..	24 „

One iron boiler; double return flues.

Length of boiler	$15\frac{1}{2}$ feet
Width of „	$10\frac{1}{4}$ „
Height of „	11 „

Heating surface 1,000 feet; fuel, soft coal.

Diameter of water wheel	$15\frac{1}{2}$ feet
Face of „ „	$5\frac{1}{2}$ „
Depth of buckets	20 inches

Hanging wheel.

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5. A large steamer for the Powhattan Co., the *Belvedere*; freight and passengers to Richmond, Va. Builders, Cooper and Butler; engine by Murry and Hazlehurst, Vulcan Works.

Length on deck	225 feet
„ between perpendiculars ..	210 „
Depth of hold	12 „
Breadth of beam	34 „
„ over guards	58 „
Draft at load line	9 „
Tonnage (custom-house measnrement	840 tons

Line of flotation slightly concave.

One beam engine.

Diameter of cylinder	50 inches
Stroke of piston	10 feet
Diameter of air pump	3 „
Stroke of air pump piston ..	$4\frac{1}{2}$ „
Area of steam valves	230 sq. inch.

One iron boiler, single return flues.

Length of boiler	24 feet
Height of „	13 „
Width of „	$11\frac{1}{2}$ „
Diameter of cylindrical part ..	11 „

Heating surface, 2,200 feet; fuel, wood.

Diameter of water wheel	29 feet
Face of „ „	$9\frac{1}{2}$ „
Depth of bucket	$2\frac{1}{4}$ „

Buckets radiated from centre of shaft. The *Belvedere* is to fill the place of the *Columbus*, recently burnt, belonging to the same company.

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6. A side wheel steamer for the Norfolk line, Bay route; builders, Cooper and Butler; engine by Murry and Hazlehurst, Vulcan Works.

Length on deck	245 feet
„ between perpendiculars ..	237 „
Breadth of beam	34 „
„ over guards	60 „
Depth of hold	11 „
Draft at load line	6 „
Tonnage (custom-house measurement)	864 tons

One beam engine.

Diameter of cylinder	56 inches
Stroke of piston	11 feet
Diameter of air pump	44 inches
Stroke of air pump piston ..	50 „

Two iron tubular boilers

Length of boilers	14 feet
Width of „	14 „
Height of „	11 „

Arch below and returns through 3 inch tubes; fuel, bituminous coal; heating surface, 4,000 square feet.

Diameter of water wheels ..	32 feet
Face of „ „ ..	$9\frac{1}{2}$ „
Depth of bucket	$2\frac{1}{2}$ „

Buckets radiate from centre of shaft.

The company to whom this boat belongs will find, to their regret, that they have limited the engineers in the size of her cylinders injudiciously. A reservation of power in the capacity of a cylinder, to meet exigences that occur during the winter passages on that route, would certainly more than pay the difference in the first cost in a short time, between a 56 and 60 inch cylinder, in the certainty of her time, and a reduced amount of wear and tear in machinery, owing to the fact that forcing her will be unnecessary.

I have for comparison taken the steamer *Vanderbilt*, running on the Long Island Sound.

Vanderbilt, tonnage, 1041, capacity of cylinder	339 cubic ft.
Norfolk Boat, tonnage, 864, capacity of cylinder	188 „
Vanderbilt cylinder, capacity to tonnage is as	1 to 3.07
Norfolk Boat cylinder, capacity to tonnage is as	1 to 4.05

Thus showing a proportion of power to tonnage, largely in favor of the *Vanderbilt*, a boat having very similar duties to perform, to that of the *Norfolk Boats.* S.

NOVELTIES.

Improved Scythes.—Messrs. Robert Sorby and Sons, of Carver-street, Sheffield, have recently registered an improvement in the manufacture of scythes and reaping-hooks, designed to increase their durability, by the substitution of solid steel points for the ordinary method of construction. Fig. 1 represents the point of the ordinary scythe; the back is made of wrought iron, and the blade of steel, which are riveted together. The back does not extend the whole length of the blade, and the vacancy is filled in with lead, which tears off in use, and leaves the point of the back exposed, to the annoyance of the mower, as it never fails to catch in the crop, and so impede his operations. This objection is neatly obviated in the plan before us, by lapping the steel point over the end of the back, so that an uniform steel back is presented for a short distance from the point. Fig. 2 shows the iron back, to be riveted to the steel blade, fig. 3, which, when finished, presents the appearance shown in fig. 4, where the iron back is completely protected by the steel, at the wearing part.

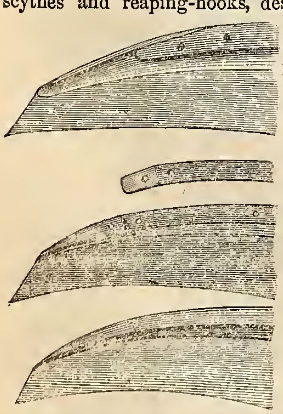


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Symon's Convertible Plane.—These planes, which we noticed in our last volume, are designed to save joiners the expense of purchasing a quantity of moulding planes, by making one stock serve for a set of moulds. Fig 1 is a section of a stock; showing how the mould is fitted to it, and Fig. 2 shows the sections of three other moulds of usual forms, which may be fitted to the same stock. The inventor states that he would fix them so that the mouth of the plane should be enlarged or contracted, so as to fit any sort of work.

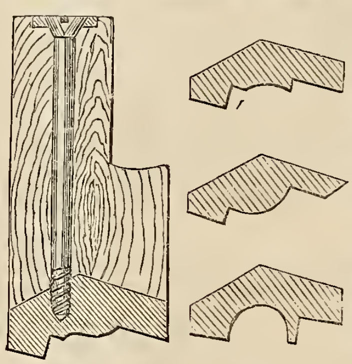


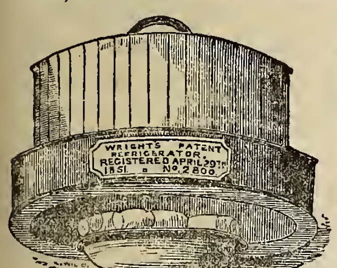
Fig. 1. Fig. 2.

The Cleveland Iron District.—The iron district covers an area of several thousand acres, lying between Guisbro' and Stokesley, in the conuty of York, and the stone contains from 30 to 40 per cent. of iron, and the seam, from 12 to 20 feet thick, lying from 1 to 20 feet below the surface, is estimated to produce 40,000 tons per acre. The supply will, therefore, be unlimited, and can be raised for a considerable time at not exceeding 6d. per ton. This extraordinary iron bed, which has been traced and tested for fifteen miles, is full of calcareous matter, and was probably a sea-shore in the antediluvian world; it is composed of ground shells and mud, and filled

with iron by percolation of water, taking up iron in solution, which it leaves behind, and in ages becomes a concrete mass; and in the ore, when examined through a magnifying glass, particles of shells are very visible. 50,000 tons have been already smelted in Northumberland, producing 33 per cent., and a contract recently made by the two proprietors to supply an iron-work with 200,000 tons per annum, for seven years, at 8s. 3d. per ton, delivered at Middlesbro', which, on a low estimate, will yield a profit of £200,000; and it is thoroughly understood that it works remarkably well, being very mild, and making capital iron. It is intended to trace the geological course of the coal veins in the district, which is expected to be found in quantity at some depth below the iron, as in other quarters. Way-leave is likely to be obtained to construct a railway from the centre of the ore, at a cost of about £2,500 per mile, to join the Stockton and Bedcar Railway, and it is fairly presumed the landed proprietors will willingly agree to a beneficial arrangement, many having engaged to do so; but should any difficulty unexpectedly arise, an Act will be applied for, the necessary survey made, and plans and sections deposited. It is also contemplated to erect ironworks on the property already secured in connexion with the rail, and concentrate the latest improvements, and thus be enabled to produce iron at the lowest possible cost, about 8s. per ton below the present rate. Three furnaces will cost about £3,000, blast-engines about £4,060, and heating apparatus about £2,000; and each furnace will produce near 900 tons of pig-iron per week by hot-blast, or 80 tons by cold; and by calcining the ore on the spot fully 25 per cent. will be saved on its carriage, and about two tons produce one ton of pig-iron.

Peat Charcoal in the United States.—In the agricultural section of the report issued from the United States' Patent Office, we find the following testimony to the merits of peat charcoal, given by an intelligent farmer, S. B. Beckett, of Portland:—"Pulverized peat charcoal (a new article) I am disposed to believe will be found to be a most excellent fertilizer, especially composted with other manures. It is a *perfect* deodorizer, rendering human excreta and the most offensive offal entirely scentless, as I have ascertained from frequent experiments. Hence, its discovery will prove of great utility to the world in a sanitary point of view, as well as for its fertilizing qualities; and I am happy to add, that a large manufactory of the article is just going into operation in our vicinity."

Society of Arts' Exhibition of Patented Inventions for 1851.—This Exhibition is now open, and we regret to find has been deprived of many most interesting objects through the perverse obstinacy of the Board of Trade, who have refused to allow it to be considered a "place of Exhibition," as required by the Act for the provisional Registry of Inventions. This, however, is perhaps not so much to be wondered at, when we remember that Lord Granville, the Vice-President of that board, is of opinion that we have no right to any Patent Laws at all. We have noted down a number of articles, some of which we must reserve for next month.



Wright's Refrigerating Apparatus is simple, and likely to be effective. It is constructed on the evaporative principle, and consists of a wire frame covered with linen, the lower edge of which stands in a small channel, into which water is poured. The water rises by the capillary action, and keeps the linen constantly moist, the evaporation from which carries off the caloric from the object placed beneath it.

Adams' Victoria Regia Sponging Bath, is designed to prevent the splashing which such ablutions are apt to cause, and this is effected by curling inwards the upper edge of the bath, so that the water in rising is caught and returned.

Young's Rotary Boot and Shoe Cleaner, consists of a set of brushes made to revolve, by a treadle and fly wheel, like a foot-lathe. This labour-saving machine is said to have been in use in the United States for some years.

(To be continued.)

LIST OF ENGLISH PATENTS.

From 20th November to 27th December, 1851.

Six months allowed for enrolment, unless otherwise expressed.

Samuel Colt, of Bond-street, Middlesex, for certain improvements in fire-arms. Nov. 22.

Thomas Marsden, of Salford, for improvements in machinery for hackling and combing flax and other fibrous materials. November 22.

Enoch Statham, of Liddals-road, Derby, for improvements in the manufacture of lace and other fabrics. November 22.

Frederick Weiss, of the Strand, Middlesex, surgical instrument maker, for improvements in certain surgical instruments; also in scissors and other like cutting instruments. November 22. (Communication.)

Frederick Benjamin Geithner, of Camden-street, Birmingham, for improvements in the manufacture of castors and legs of furniture. November 22.

Jean Baptiste Cbalmin, of Rouen, merchant, for improvements in preparing and weaving cotton. November 22.

William Armand Moreau Gilbee, of South-street, Finsbury-square, London, gentleman, for certain improvements in the process of, and apparatus for, treating fatty oleaginous matters, and in the manufacture of candles and other useful articles therefrom. November 22. (Communication.)

George Mills, of Southampton, Hampshire, engineer, for improvements in steam-engine boilers and in steam propelling machinery. November 22.

Alexander Southwood Stocker, of Wandsworth, Surrey, gentleman, for certain improvements in the stoppering or stopping of bottles, jars, pots, and other such-like receptacles. November 22.

Henry Ellwood, of the firm of J. Gillwood and Sons, of Great Charlotte-street, Blackfriars, hat manufacturers, for improvements in the manufacture of hats. November 27.

Richard Whytock, of Edinburgh, for improvements in applying colours to yarns or threads, and in weaving or producing fabrics when coloured or party-coloured yarns or threads are employed. November 27.

John Lee Stevens, of Kennington, Surrey, gentleman, for certain improvements in propelling vessels on water. November 27.

William Exall, of Reading, Berkshire, engineer, for improvements in certain agricultural implements; and in steam-engines and boilers for driving the same. December 1.

George Laycock, late of Doncaster, Yorkshire, but now of Albany, in the state of New York, in the United States of America, dyer, for improvements in unhairing and tanning skins. December 1.

William Grayson, of Henley-on-Thames, Oxfordshire, watch and clock maker, for an odometer, or road measurer, to be attached to carriages for showing distances over which the wheels pass. December 1.

Thomas Burstall, of Lee-crescent, Edgbaston, Warwickshire, civil engineer, for certain improved machinery for manufacturing bricks and other articles from clay alone, or mixed with other materials. December 1.

John Macintosh, of Berners-street, Middlesex, civil engineer, for improvements in steam-engines, in rigging and propelling vessels, and facilitating their progress through water. December 4.

William Wood, of Oxford-street, Middlesex, carpet manufacturer, for improvements in the manufacture and ornamenting of carpets, rugs, and other fabrics. December 4.

James Thompson, and Frederick Altree, of Compton-street, Brunswick-square, bakers, for certain improvements in the means of, and apparatus for heating ovens. December 5.

Joseph Harrison, of Oxford-square, Hyde-park-gardens, engineer, for certain improvements in steam-engines and boilers. December 8.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for improvements in the apparatus for kneading and baking bread, and other articles of food of a similar nature. December 8. (Communication.)

Richard Archibald Brooman, of Fleet-street, London, for certain improved modes of applying electro-chemical action to manufacturing purposes. Dec. 8. (Communication.)

Richard Archibald Brooman, of Fleet-street, London, for improvements in the manufacture of sugar, in the preparation of certain substances for such manufacture, and in the machinery and apparatus employed therein. December 8. (Communication.)

Isaac Alexander, of High Holborn, Middlesex, biscuit-baker, for a mode of preparing and treating certain kinds of cheese, whereby to render the same applicable to a variety of culinary and other domestic purposes. December 8.

Perry G. Gardiner, of New York, in the United States of America, civil engineer and machinist, for improvements in the manufacture of malleable metals into pipes, hollow shafts, railway wheels, or other analogous forms, capable of being dressed turned down, or polished in a lathe. December 8.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in separating coal from foreign matters, and in apparatus for that purpose. December 8. (Communication.)

William Pidding, of the Strand, gentleman, for improvements in the treatment, manufacture, and application of materials or substances for building purposes. December 8.

John Lake, of Apsley, Hertfordshire, civil engineer, for improvements in propelling on canals and rivers. December 8.

Thomas Restell, of the Strand, Middlesex, watchmaker, for improvements in locks or fastenings. December 8.

John Frearson, of Birmingham, for improvements in cutting, shaping and pressing metal and other materials. December 10.

James Webster, of Leicester, for improvements in drying gloves, and other articles of hosiery. December 10.

Etienne Alexandre Armand, of Paris, for improvements in the modes of distilling and treating organic substances, and bituminous matters, and in the treatment of their products, together with the apparatus used for the said purposes. December 10.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in dyeing textile fabrics. December 10. (Communication.)

Thomas Masters, of Regent-street, confectioner, for improvements in retaining and drawing off aerated and other liquids, and in charging vessels with gaseous fluids, applicable to vessels for holding solid matters, and also as a fastening for utensils and apparatus, and in holders for cigars. December 11.

Thomas Twells, of Nottingham, manufacturer, for certain improvements in the manufacture of looped fabrics. December 15.

Frederick William Norton, of Paisley, Renfrewshire, North Britain, manufacturer, for certain improvements in the manufacture or production of plain and figured fabrics. December 16.

John Gedge, of Wellington-street, Strand, Middlesex, for improvements in the treatment of certain substances for the production of manures. December 16. (Communication.)

James Souter and James Worton, of Birmingham, for improvements in the manufacture of papier mache, and in articles made therefrom, and in the manufacture of buttons, studs, and other articles, where metal and glass are combined. December 17.

William Hirst, of Manchester, manufacturer, for certain improvements in machinery or apparatus for manufacturing woollen cloth, and cloth made from wool and other materials. December 19.

Moses Poole, of London, gentleman, for improvements in apparatus for excluding dust and other matters from railway carriages, and for ventilating them. Dec. 19. (Communication.)

Henry Clayton, of Atlas Works, Upper Park-place, Dorset-square, for improvements in the manufacture of tubes, pipes, tiles, and other articles made from plastic materials. Dec. 19.

Samuel Wilkes, of Wolverhampton, brass-founder, for improvements in the manufacture of kettles, in saucepans, and other cooking vessels. December 19.

Joseph Burch, of Craig Works, Macclesfield, for improvements in printing and ornamenting cut-pile and other fabrics and yarns. December 19.

Christopher Rands, of Shad Thames, miller, for improvements in grinding wheat and other grain. December 19.

James Frederick Lackersteen, of Kensington-square, civil engineer, for improvements in machinery for cutting and splitting wood and other substances, and in the manufacture of boxes. December 19.

Frederick Bousfield, of Devonshire-place, Islington, gentleman, for a new manufacture of manure. December 19.

Charles Howland, of New York, engineer, for improvements in apparatus for ascertaining and indicating the supply of water in steam-boilers. December 19.

William Elliott, of Birmingham, manufacturer, for improvements in the manufacture of covered buttons. December 19.

Rodolphe Helbronner, of Regent-street, for improvements in apparatus used when obtaining instantaneous light. December 19.

John Thornton and James Thornton, both of Melbourne, Derbyshire, mechanics, for improvements in the manufacture of meshed and looped fabrics, and other weavings, and in raising pile and looped fabrics and other weavings. December 19.

William Emery Milligan, mechanical engineer, of New York, for certain improvements in the construction of boilers for generating steam. December 19.

Charles Lamport, of Workington, Cumberland, shipbuilder, for improvements in reefing sails. December 19.

Richard Archibald Brooman, of Fleet-street, for improvements in sounding instruments. December 19. (Communication.)

John Davie Morries Stirling, of Black Grange, North Britain, esq., for certain alloys and combinations of metals. December 22.

Sydney Smith, of Nottingham, for improvements in indicating the height of water in steam-boilers. December 22.

Augustus Applegarth, of Dartford, Kent, for improvements in machinery used for printing. December 24.

Antonio de Sola, of Madrid, Spain, for certain improvements in the treatment of copper minerals. December 24. (Communication.)

Christopher Nickels, of York-road, Lambeth, and Thomas Ball, and John Woodhouse Bagley, of Nottingham, for improvements in the manufacture of knitted, looped, and other elastic fabrics. December 24.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in separating substances of different specific gravities. December 24.

Joseph Stenson, of Northampton, engineer and iron manufacturer, for improvements in the manufacture of iron, and in the steam apparatus used therein, part or parts of which are also applicable to evaporative and motive purposes generally. December 27.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND,

From the 22nd day of October to the 22nd day of December, 1851.

Edwin Deeley and Richard Mountford Deeley, of Andnam Bank, Staffordshire, flint and bottle glass manufacturers, for improvements in the construction of furnaces for the manufacture of glass. October 31.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for certain improvements in the construction of railways. November 4. (Communication.)

William Smith, of Upper Grove-cottages, Holloway, Middlesex, engineer, for improvements in locomotive and other engines, and in carriages used on railways. November 4.

Robert Hyde Greg, of Manchester, Lancashire, manufacturer and merchant, and David Bowlas, of Reddish, Lancashire, manufacturer, for certain improvements in machinery or apparatus for manufacturing weavers' healds or harness. November 4.

Michael Scott, of John-street, Adelphi, civil engineer, for improvements in punching, rivetting, bending, and shearing metals, and in building ships. November 5.

Benjamin Hallewell, of Leeds, Yorkshire, wine merchant, for improvements in drying malt. November 5.

Matthew Gibson, of Wellington-terrace, Newcastle-upon-Tyne, for improvements in machinery for pulverizing and preparing land. November 7.

William Longmaid, of Beaumont-square, gentleman, for improvements in treating ores and minerals, and in obtaining various products therefrom, certain parts of which improvements are applicable to the manufacture of alkali. November 7.

Antoine Dominique Sisco, of Slough, for improvements in the manufacture of chains, and in combining iron with other metals applicable to such, and other manufacture. Nov. 11.

Henry Lund, of the Temple, esq., for improvements in propelling. November 12.

Frederick Joseph Bramwell, of Millwall, Middlesex, engineer, for improvements in working the valves of steam-engines for marine and other purposes, and in paddle-wheels. November 12.

William Boggett, of St. Martin's-lane, gentleman, and George Holworthy Palmer, of Westbourne villas, Paddington, civil engineer, for improvements in obtaining and applying heat and light. November 14.

Henry Richardson, of Aber Hernant, Bala, North Wales, esq., for certain improvements in life-boats. November 14 (four months.)

James Bagster Lyall, of Thurloe-square, Brompton, Middlesex, gentleman, for an improved construction of public carriage, November 14 (four months.)

James Pyke, of Westbourne-grove, Bayswater, Middlesex, for improvements in the manufactnre of leather, also in making boots and shoes. November 17.

Hugh Bowlsby Wilson, of the York Hotel, Blackfriars, London, for improvements in the construction of rails for railways. November 19.

George Tate, of Bawtry, Yorkshire, gentleman, for improvements in the construction of dwelling-houses and other buildings, including carriages and floating vessels, and in the propulsion of said vessels, and in the adaptation and manufacture of materials for such uses. November 21.

Richard Whytock, of Edinburgh, for improvements in applying colours to yarns or threads, and in weaving or producing fabrics when coloured or party-coloured yarns or threads are employed. November 24.

Thomas Crook, of Preston, Lancashire, cotton manufacturer, and James Mason, of Preston aforesaid, warper, for certain improvements in looms for weaving. November 26.

Thomas Cussons, of Bunhill-row, Middlesex, for improvements in ornamenting woven fabrics for bookbinding and its uses. November 26.

Henry Ellwood, of the firm of Ellwood and Sons, of Great Charlotte-street, Blackfriars-road, Surrey, wholesale hat manufacturers, for improvements in the manufacture of hats, and other coverings for the head. November 26.

John Ashworth, of Bristol, manager of the Great Western Cotton Works, for certain improvements in the method of preventing and removing incrustations in sseam-boilers and steam-generators. November 26.

Joshua Grindrod, of Birkenhead, Cheshire, consulting engineer, for an improvement in the machinery for communicating motion from steam-engines, or other motive power, and in the construction of rudders for vessels. December 1.

William Brydges Adams, of Adam-street, Adelphi, Middlesex, engineer, for certain improvements in the construction of roads and ways for the transit of passengers, of materials, and of goods; also in building and in bridges, parts of which improvements are applicable to other like purposes. December 4.

Godfrey Ermen, of Manchester, Lancashire, cotton-spinner, for certain improvements in the method of, and apparatus for, finishing yarns or threads. December 1.

James Nasmyth, of Patricroft, Lancashire, engineer, and Herbert Minton, of Stoke-upon-Trent, Staffordshire, china manufacturer, for certain improvements in machinery or apparatus to be employed in the manufacture of tiles, bricks, and other articles, from disintegrated or pulverized clay. December 11.

Frederick William Norton, of Paisley, Renfrewshire, North Britain, manufacturer, for certain improvements in the manufacture or production of plain and figured fabrics. Dec. 12.

John Cumming, of Paisley, Renfrewshire, North Britain, pattern designer, for improvements in the production of surfaces for printing or ornamenting fabrics. December 15.

John Livesey, New Lenton, Nottingham, draughtsman, for improvements in the manufacture of textile fabrics, and in machinery for producing the same. December 15.

Augustus Applegarth, of Dartford, Kent, for improvements in machinery used in printing. December 22.

William Dickinson, of Blackburn, Lancashire, machine maker, for certain improvements in machinery or apparatus for manufacturing textile fabrics. December 22.

George Gwynne, of Hyde Park square, Middlesex, esq., and George Fergusson Wilson, managing director of Price's Patent Candle Company, of Belmont, Vauxhall, for improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night-lights, and soap. December 22.

Herman Schroeder, of Bristol, gentleman, for improvements in the manufacture and refining of sugar, which improvements are applicable to evaporating other fluids where a low temperature is advantageous. December 22.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND,

From the 21st Day of September to the 19th Day of December.

Samuel Holt, of Stockport, Cheshire, manager, for certain improvements in the manufacture of textile fabrics. September 24.

Henry Wimshurst, of Broad-street, Radcliff-cross, Middlesex, ship-builder, for improvements in steam-engines, in propelling, and in the construction of ships and vessels. Sept. 30.

Charles Hardy, of Low Moor, Yorkshire, esq., for certain improvements in the manufacture of scythes. October 6.

Peter Robert Drummond, of Perth, for improvements in churns. October 20.

John Oxland and Robert Oxland, of Plymouth, chemists, for improvements in the manufacture and refining of sugar. November 3.

James Webster, of Leicester, engineer, for improvements in the construction and means of applying carriage and certain other springs. November 3.

Alexis Delemer, of Radcliffe, Lancashire, engineer, for certain improvements in the application of colouring matter to linen, cotton, silk, woollen, and other fabrics, and to linen, cotton, silk, and other wefts, and also in machinery or apparatus for those purposes. November 5.

Percival Moses Parsons, of Duke-street, Adelphi, Middlesex, civil engineer, for improvements in parts of railways, and in cranes. November 18.

Thomas Crook, of Preston, Lancashire, cotton manufacturer, and James Mason, of Preston aforesaid, warper, for certain improvements in looms for weaving. November 20.

Henry Richardson, of Aber Hernant, Bala, North Wales, esq., for certain improvements in life boats. November 20.

George Tate, of Bawtry, Yorkshire, gentleman, for improvements in the construction of dwelling houses and other buildings, including carriages and floating vessels, and in the propulsion of said vessels, and the adaptation and manufacture of materials for such uses. December 2.

Philip Nind, of Leicester-square, gent., for improvements in the manufacture of sugar, in distilling and in cutting and rasping vegetable substances. December 2.

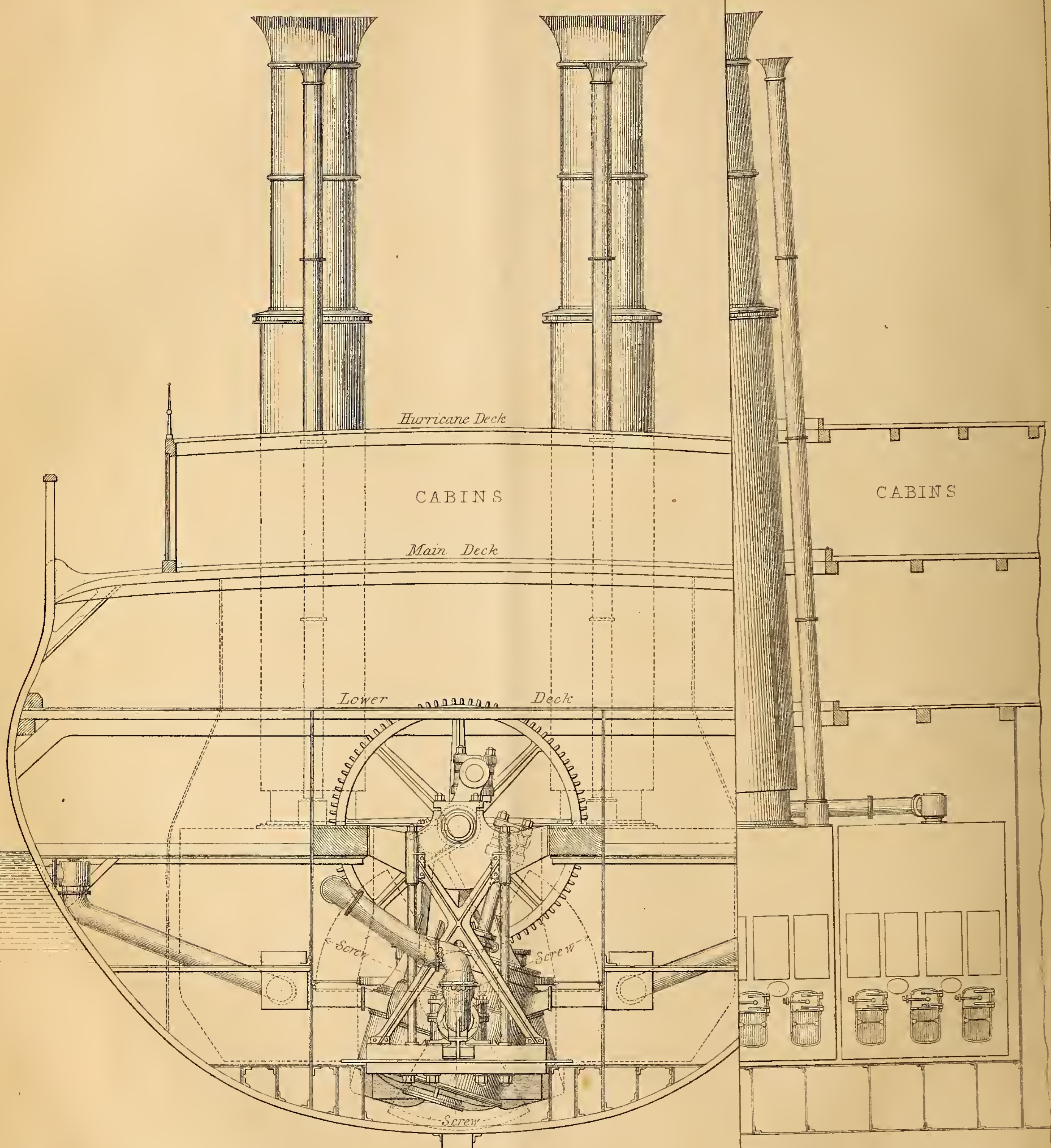
George Fergusson Wilson, managing director of Price's Patent Candle Company, Vauxhall, David Wilson, of Wandsworth, esq., James Childs, of Putney, esq., and John Jackson, of Vauxhall, gent., all in Surrey, for improvements in presses and matting, and in the process of and apparatus for treating fatty and oily matters, and in the manufacturing of candles and night lights. December 19.

DESIGNS FOR ARTICLES OF UTILITY.

From the 21st November to the 23rd December 1851, inclusive.

November 21, 3021, William Ashton, South, Lincolnshire. "Sponging-bath."
„ 21, 3022, Joseph and Alfred Ridsdale, Minories, "Fastening for ship's scuttle-lights or ports.
„ 21, 3023, Stephen M. Feary, Willingham, near Cambridge, "Wheel-supporter."
„ 22, 3024, J. Biggs and Sons, Leicester, "Shirts made of looped fabrics."
„ 24, 3025, William Barwell, Birmingham, "Metallic reel."
„ 25, 3026, Robert McConnell, Port Dundas-road, Glasgow, "Model water-closet."
„ 25, 3027, John William and Thomas Allen, Strand, "Despatch-box."
„ 26, 3028, Henry Watson, High-Bridge Works, Newcastle-on-Tyne, "Parts of a safety-lamp."
„ 26, 3029, William Dray, Swan-lane, City, "Bullock-tie."
„ 26, 3030, Dent, Allcroft, and Co, Wood-street, Cheapside, "Collar-fastening."
„ 27, 3031, Samuel Hemmings, Merrywood-hall, Bristol, "Combined lactometer and milk-vessel."
„ 27, 3032, William Hodgson, West-End-buildings, Bradford, Yorkshire, "Improved spool motion."
„ 28, 3033, Robert Adams, King William-street, City, "A projectile."
„ 29, 3034, Moses Wright, Bingley, Yorkshire, "A shuttle."
December 1, 3035, William Marr, Cheapside, "Improved girder."
„ 2, 3036, C. A. and T. Ferguson, Mast-house, Millwall, Poplar, "Compresser for gun-carriages."
„ 2, 3037, John Gillam, Woodstock, "Seed-cleanser and separater."
„ 3, 3038, Thomas B. Gale, Victoria-street, Homerton, "A boring tool."
„ 3, 3039, Thomas Paris, Greenwood, Barnet, "A brick."
„ 3, 3040, Thomas Paris, Greenwood, Barnet, "A brick."
„ 4, 3041, John Sanders, Upper Hockley-street, Birmingham, "Adjusting lock furniture."
„ 4, 3042, Wolf and Baker, Sambrook-court, Basinghall-street, "Condensing tobacco-pipe stem."
„ 4, 3043, Richard Garrett, Leiston works, Saxmundham, "Reciprocating knife for reaping-machines."
„ 4, 3044, James Slipper, Leather-lane, "The bronchita tube"
„ 5, 3045, George Sant, Pomona-place, Fulham, "A milk-tester."
„ 5, 3046, Francis Whishaw. John-st., Adelphi, "Telekonphonon (speaking-tube.)"
„ 5, 3047, Maurice Moses, Tower-hill, "Janus coat."
„ 6, 3048, John Charles Evans, King William-street, London-bridge, "Revolving curtain-runner."
„ 6, 3049, Edward N. Fourdrinier, Sunderland, "Penholder."
„ 8, 3050, John Hicks, Dorchester, "Stove."
„ 1, 3051, W. Flatau and Co., Mansell-street, Goodman's-fields, "A shoe."
„ 9, 3052, Henry Stephens, Stamford-street, Blackfriars-road, "Improved parallel ruler."
„ 9, 3053, Cripps and Lindup, Warwick-street, Worthing, "Coat"
„ 10, 3054, A. Lyon, Windmill-street, Finsbury, "Sausage meat-cutter."
„ 10, 3055, Charles Clarke, Birmingham, "Casement-stay and fastener."
„ 11, 3056, James Thornton and Sons, Bradford-street, Birmingham, "Glass guage-tube for railway engines."
„ 12, 3057, Edward J. Dent, Strand, "Prismatic balance."
„ 13, 3051, James Neighbour, High-street, Windsor, Berks, "Geometrical fimbria, or shirt, with graduating corset for females and children."
„ 16, 3059, Charles Rowley, Newhall, Birmingham, "Lead and slate pencil and crayon sharpener."
„ 16, 3060, Williamson and Roberts, Heaton Norris, Lancashire, "Apparatus for taking up the cloth in looms."
„ 16, 3061, Edwin Kesterton, Long-Acre, "Improved frame for carriage-windows."
„ 17, 3062, Joseph Welch and Margetson, Cheapside, "Oxonian shirt-front."
„ 17, 3063, Samuel Whitfield, Oxford-street, Birmingham, "Improved fastening for metallic bedsteads."
„ 18, 3064, James Haywood, Phoenix Foundry, Derby, "A stench-trap."
„ 20, 3065, Charles Lenny, Croydon, Surrey, "Wicker-bodied carriage."
„ 23, 3066, Joseph J. Lane, Coventry-street, Bethnal-green, "The lozenge-cutting machine."

ENG



W. K. Whytehead C.E. direx.

H. Adlard

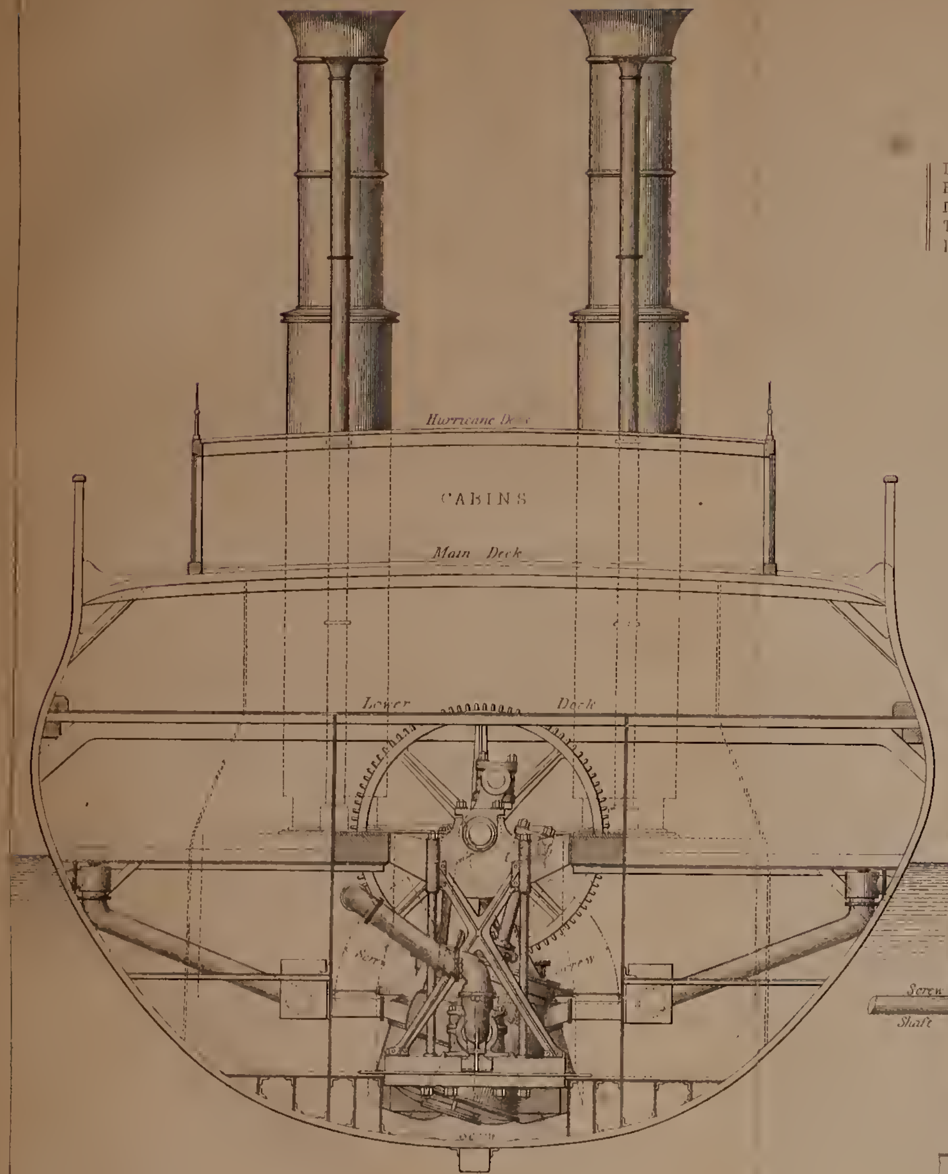
ENGINES AND BOILERS OF THE GREAT BRITAIN STEAM SHIP.

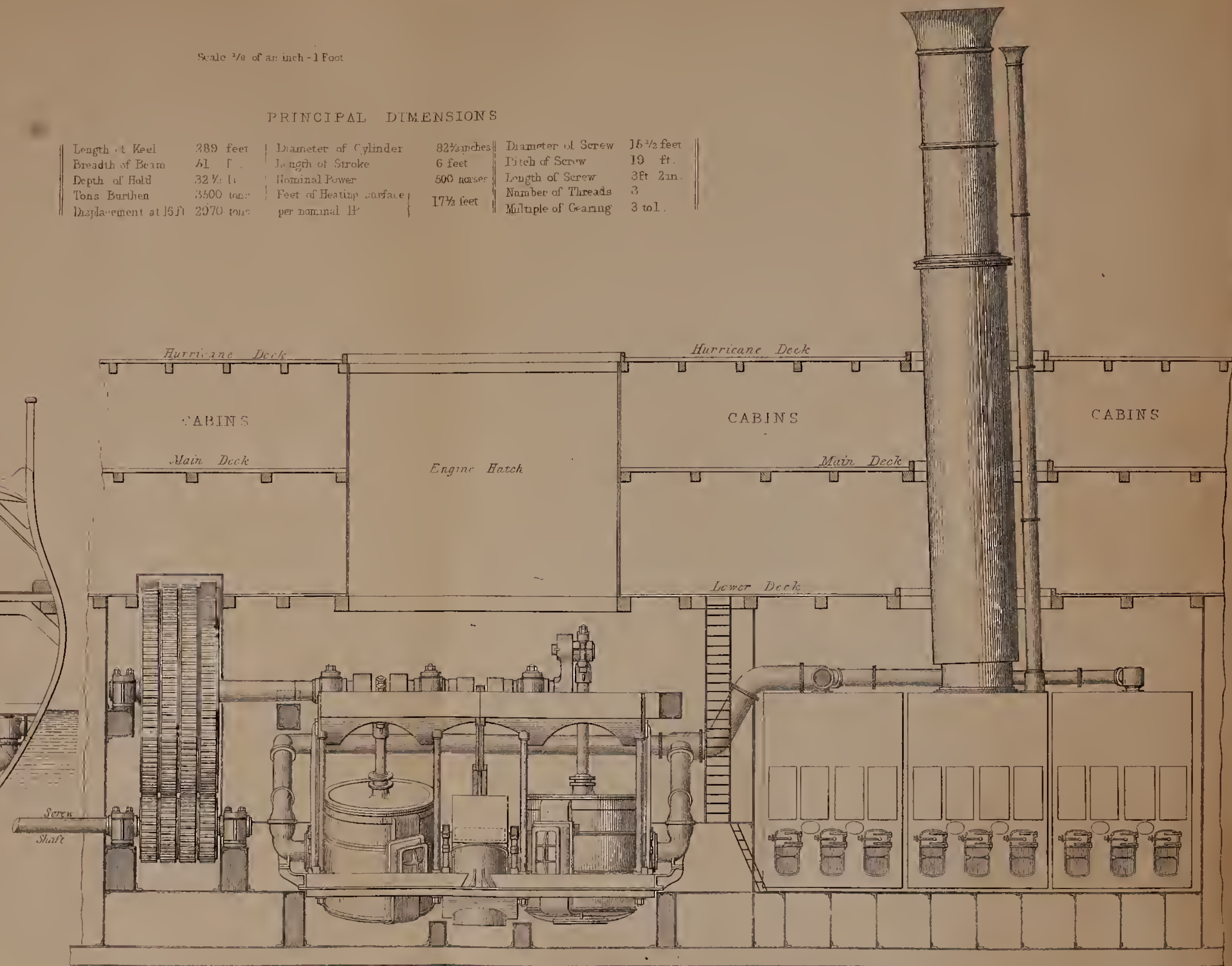
Constructed by Messrs J. Penn & Son, Engineers, Greenwich.

Scale 3/8 of an inch - 1 Foot

PRINCIPAL DIMENSIONS

Length of Keel	389 feet	Diameter of Cylinder	82½ inches	Diameter of Screw	15½ feet
Breadth of Beam	51 ft.	Length of Stroke	6 feet	Pitch of Screw	19 ft.
Depth of Hold	32½ ft.	Nominal Power	500 horses	Length of Screw	3ft 2in.
Tons Burthen	3500 tons	Feet of Heating surface per nominal HP	17½ feet	Number of Threads	3
Displacement at 16 ft	2970 tons			Multiple of Gearing	3 to 1.





STAMPING PRESS,
By M. Guillaume. Paris.

Fig.1

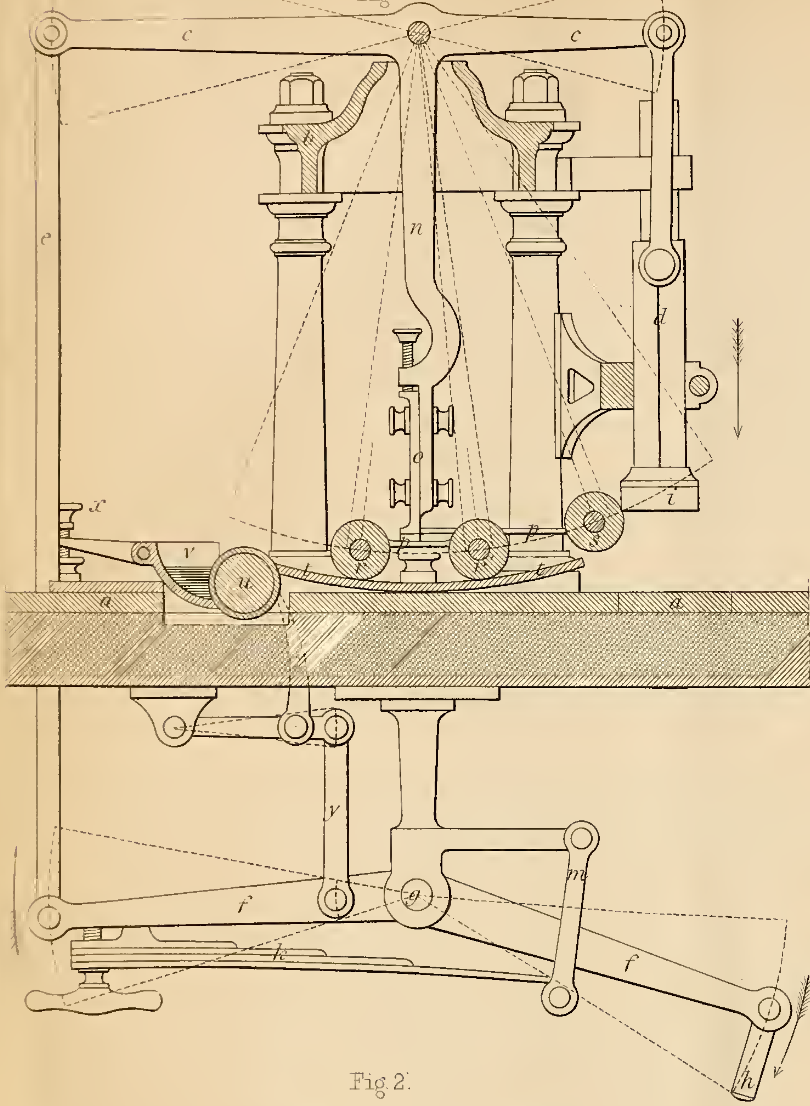
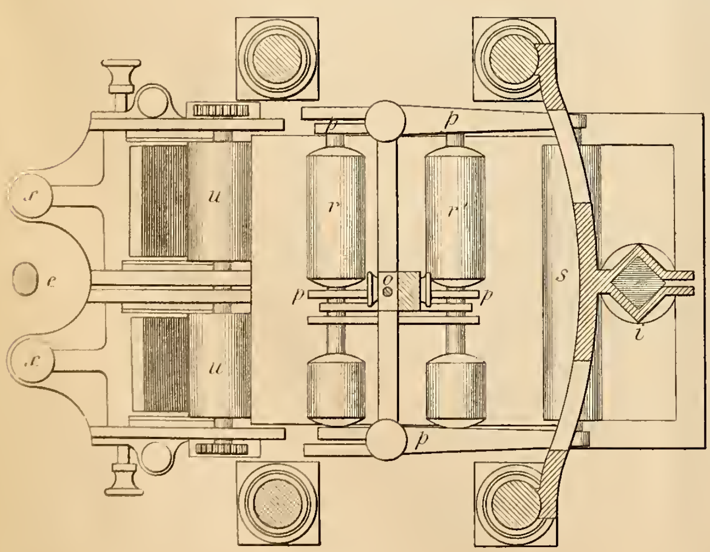
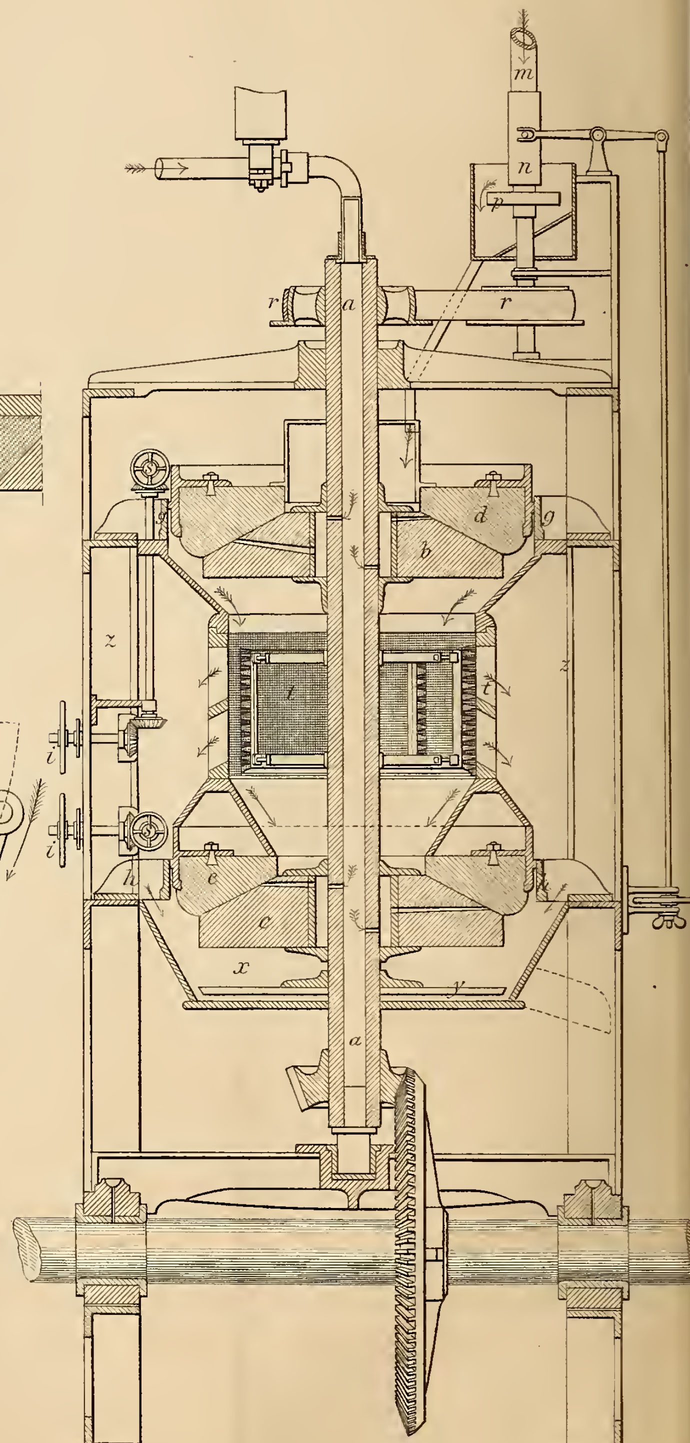


Fig. 2.



Scale, 2 inches to 1 foot.

WESTRUP'S PATENT CONICAL FLOUR MILL.



Scale, 5/8 inch to 1 foot.

H. Adlard sc.

THE ARTIZAN.

No. II.—Vol. X.—FEBRUARY 1st, 1852.

ON DESIGNING DETAILS OF MACHINERY.

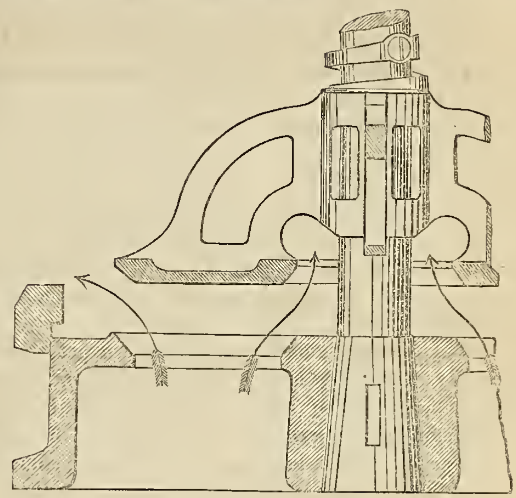
The remarks which we recently made on the engines designed by Mr. Carlson for the screw, have excited the susceptibility of more than one of our readers, who have hastened to impress upon us that all the details in those engines are to be found embodied in the practice of various English engineers. Even admitting this fact to the fullest extent, the selection and combination of good details is a qualification in which many engineers exhibit a lamentable deficiency. Durability and economy in repairs are too often sacrificed in the attempt to economise in first cost, or from an inadequate notion of the importance of details. Some of our sea-going engineers, and those who have been employed in the colonies, could "a tale unfold" which would sadly tarnish the lustre with which the names of our "eminent engineers" are surrounded. An instance occurs to us where the cylinder covers of a pair of large marine engines had been fitted so nicely, their *whole depth*, into the cylinders, that their removal entire was found perfectly impracticable, and they had to be cut out, and fresh covers made in two pieces, to allow of their being got into their places.

Many details of engines and machinery are still copied from the productions of our forefathers, in a servile spirit of imitation, which locomotive engineering has weakened, but has not yet exploded. A correspondent has written to direct attention to the application of the dished piston to locomotives, where reduction of weight is a great desideratum. We may also point out the facility which its form presents for making it of wrought iron, as it could be finished under the hammer, like Smith's solid wrought iron railway wheel, described p. 178, vol. 1849.

We propose to give a few examples of modifications of details, in which we hope to be assisted by contributions from our readers.

VALVES AND COCKS.

Amongst the various forms of valves which have been employed for air-pumps, we may note, first, the butterfly valve, which was no doubt copied, in the early engines, from the leather bucket-valve; the change of the material being necessary to resist the high temperature of the water to which it was exposed. For land-engines, the buckets were made of cast-iron, with brass faces rivetted on, and the valves were of solid brass. For marine engines, exposed to salt water, buckets entirely of brass were found necessary; and we have seen some taken out of old boats, which, from their weight, seemed to have been cast off patterns originally made for a land engine. In large buckets, the weight in the valves caused them to strike hard; and the evil was increased when a higher speed of engine was introduced. The most obvious remedy was to diminish their weight, by dividing them into a number of smaller ones. This was done by Mr. Spiller, of Battersea, by filling up the available area with a number of small circular valves, free to rise and fall independent of each other, which divided the water into numerous small streams. Another plan, introduced by Messrs. Maudslay and Field, was to divide the bucket into annular rings, with valves of a corresponding shape. An object gained by this arrangement was an economy in construction, arising from the facility gained for doing all the work in the lathe, the cheapest mode of getting up metallic surfaces. The disadvantage appears to be that, the rings being only steadied by ribs on their internal circumference, will not rise and fall steadily. This will be understood from the manner in which a half-crown falls, when allowed to roll on a table and fall on its face. We have not seen any satisfactory plan for guiding more than one ring; but that may be readily done, as in the accompanying sketch, which, it will be seen, is



Scale 1½ in. to a foot.

only the "pot-lid" valve, with an opening in the centre, which gives an additional area for the passage of the water, and reduces the weight of the valve. It is simple and effective for buckets of a moderate size, and can be entirely fitted up in the lathe. The boss is made of adequate depth, to give steadiness, and is lightened out, as are also the feathers; the object being not only to save brass, but to diminish the concussion by reducing the weight. The guard attached to the rod, to prevent the valve rising too high, is made of a piece of steel, bent round so as to form a spring.

The concussion on the closing of the valve has been removed by some engineers, by forming a recess, out of which the valve has to force the water before it can close. A neat plan for this is wanted, although it may be done with a separate valve, on the "dash-pot" plan, as used in America (see p. 182, vol. 1850.) The necessity for this expedient is now, however, removed by the use of a different material. A patent was taken out by Mr. Humphries (formerly of Messrs. Rennie's establishment), for a pump-bucket, divided into a number of radial openings, which were closed by valves made of thin strips of metal, held down at their inner ends by metal screws, and the elasticity of which kept them

closed. These were designed, we believe, for screw-engines, and the facility with which a valve could be taken out and replaced, in case of accident, was considered a recommendation. Whatever advantages further experience of their use might have shown them to possess, they were speedily abandoned in favour of a new material, vulcanized india-rubber, the application of which an eminent practical authority has pronounced to be the most important improvement made in the steam-engine, since Watt's invention of the separate condenser.

Without going quite so far as that, we may admire the fortunate discovery of such a useful material, just at the time when an increase of speed demanded some such an invention. Vulcanised india-rubber is now used, not only for the air pumps, but also for the feed and bilge pumps, the absence of noise in working being a great convenience, even if it possess no other advantage.

THE IRISH DIFFICULTY AND ITS SOLUTION.

FLAX, COTTON AND BEET ROOT SUGAR.*

(Continued from page 4.)

This falling off in the quantity of flax grown in Ireland is the more extraordinary, as its cultivation has been encouraged with no ordinary degree of vigour by the Royal Flax Society, by disseminating information on the various processes, both by popular publications and by lectures. Indeed, so important was the question felt to be, that the Society was encouraged by the patronage of the Government, and by annual grants of public money. The case was certainly very plausible. It is estimated that the importation of foreign flax is of the following values:—Fibre, £5,000,000; seed for crushing and sowing, £2,000,000; oil cake, £600,000; making a total of £7,600,000, all of which might be supplied by our own farmers. With such a demand, there must be some good reason for the apathy with which both Irish and English farmers suffered themselves to be supplanted in their own markets. There are two questions to be answered:—first, Can a remunerating price be obtained by the British grower? and, secondly, Can the market be readily reached?

On the first of these questions, we may of course get statements of every shade of variety. This is to be expected in a crop, the cultivation of which is the exception, rather than the rule. With the necessary *data*, some opinion may be formed of the profit on a crop of wheat, because the average of a district cannot be far wrong; but with flax, the question is more complicated. One writer states, that on eight acres of land in Ireland, sown with flax, he had a clear profit of £16 per acre, although he did not save the seed. Mr. Druce, of Ensham, in Oxfordshire, in a statement made to the Royal Agricultural Society, gives the following as the balance of expenses and profit on his farm, which is on the Oxford clay formation, the piece of ground on which the flax was grown consisting of deep red loam.

"1.—Expenses of Cultivation.

	£	s.	d.
One ploughing at 10*s*. per acre	£2	17	3
Sowing and harrowing, at 1*s*. 6*d*. per acre ..	0	8	7
Weeding, at 2*s*. per acre	0	11	5
Flax-seed, 13½ bushels, at 9*s*.	6	1	6
Rent of land, at 48*s*. per acre	13	14	9
Taxes, at 6*s*. per acre	1	14	4
Pulling flax, at 14*s*. per acre	4	0	1
Carting and stacking at 4*s*. per acre	1	2	10
Thrashing	5	7	1
Winnowing	0	12	6
Total expenses	36	10	4

2.—Sale of Produce.

	£	s.	d.
Sale of flax seed, 20¼ bushels per acre—116¼ bushels, at 8*s*.	£46	10	0
Sale of flax straw, 12 tons 2 cwt. 2 qrs., at £3 per ton..	36	7	6
Sale of chaff, at 5*s*. per acre	1	8	7
Total receipts	£84	6	1

"Leaving a net profit of £47 15*s*. 9*d*. on the 5A. 2R. 36P., being equal to £8 6*s*. 2*d*. per acre of land employed in this trial of flax cultivation.

Mr. Druce expressed his opinion, at all events, that it would be found a good thing for every farmer to grow some flax on his farm, if only for the purpose of working up his inferior hay, with a paste of beans and flax seed, as food for his cattle."

The information which, it will be perceived, is wanting to make this statement complete, is the quantity and cost of the manure necessary to *restore* to the land those constituents of which the flax has deprived it. This would diminish the net profit, although to what extent we find no definite evidence. Mr. Claussen himself says (*ante* p. 3), "The capsules of the seeds, the husks of the capsules, and the seeds, contain a very large proportion of nitrogen and phosphoric acid, and may consequently be advantageously employed for the purposes of manure or for the feeding of cattle." And again:—"In cases where, in the course of preparation of the flax, the seed and the whole of those portions of the plant which have absorbed the nutritive matters from the soil, are destroyed by steeping, *and where nothing is left to be returned to the soil, there can be no doubt that the crop is an exceedingly exhaustive one*." Now, it will be observed, that in the preceding estimate, credit is taken for the whole of the seed, the straw, and the chaff—in fact, the whole crop; and if the seed alone were returned to the land as manure, it would reduce the receipts more than one half, and render the profit nothing. In practice, we presume, the seed would be applied to fattening cattle, the manure from which, added to their increased value, would assist in improving the balance sheet, though not to the extent for which Mr. Claussen takes credit.

Mr. Seymour goes still further, and gives the following estimate of a wheat crop, communicated to him by a Norfolk farmer:—

WHEAT.

Dr.	£	*s.*	*d.*
To 8 acres of land, at 26*s*. 9*d*.	10	14	0
120 loads farm-yard manure, at 4*s*.	24	0	0
Drawing ditto	3	0	0
Spreading	1	4	0
Ploughing..........	3	0	0
Harrowing and rolling	0	12	0
80 pecks of seed	5	16	0
Drilling............	1	0	0
Rolling and harrowing	0	8	0
Hoeing	1	12	0
Watching	0	8	0
Reaping	2	8	0
Carting............	2	8	0
Thrashing	5	12	0
Tithe..............	1	12	0
Poor rates..........	0	16	0
Church and survey rates	0	12	0
Balance or profit	13	6	0
	£78	8	0

WHEAT.

Cr.	£	*s.*	*d.*
By 224 bushels, at 5*s*. 6*d*.	61	12	0
Straw	16	16	0
	£78	8	0

With this is compared the statement of a farmer in *Ireland*, who says "I calculate, after making a liberal allowance for expenses, I had more than £16 per acre clear profit." And as this was without saving the seed, another £9 per acre ought to be added on that score, and another £6 or £8 for the improved method of managing the crop, making a total of say £31 per acre profit! As we remarked before, this only shows how vague any estimate must be, unless based on the experience of a

* *How to Employ Capital in Western Ireland*, by W. D. Seymour. London, Hearne. *The Flax Movement*, by the Chevalier Claussen. London, Effingham Wilson.

whole district. But the lowest estimate, £8 6*s.* 2*d.*, would admit of a reduction to pay for manure, and then leave a good profit.

Taking the whole body of evidence, we think there can be no doubt that the cultivation of flax, with the ordinary market prices, would prove remunerative to the farmer, whether in England or Ireland. It only remains, therefore, to consider the second question, how the market is to be reached.

On this, which we may call the mechanical part of the subject, there is ample room for improvement. What should we think if foreign farmers were to send shiploads of wheat to this country, in the ear, unthrashed? And yet this is precisely what our flax growers have been doing, and then they complain that the cost of carriage absorbs all the profits! At page 149, vol. ix, in an article on flax machinery, will be found a description of various processes of "retting" or rotting the flax to prepare it for market, and which we need not here repeat. This process is equivalent to thrashing, and the reasons assigned for not carrying out this process on the spot where the flax is grown are numerous and appear cogent. They are thus laid down by Mr. Claussen:—

Dew Retting.—Under the system of preparing the flax hitherto, four modes of steeping or retting the plant are resorted to. The first consists of the plan of "dew retting," or allowing the flax to remain exposed on grass land for a considerable number of days exposed to the action of the rain, dews, and atmosphere. The plan, however, is one which, from its obvious inconveniences, is not calculated to meet with general approval in the present advanced state of agriculture, and is, indeed, very rarely adopted.

Steeping in Streams.—Probably the best mode of steeping the flax is that of placing it in running streams, according to the mode adopted in Courtrai, the principal flax-growing district in Belgium. The flax so prepared generally realizes a much higher price than any other description. There are, however, certain peculiarities in the water of the river Lys which makes it admirably adapted for steeping purposes, and which are not possessed by any of the streams in this country. Independent of the peculiarities of the water, the steeping of flax in running streams cannot be made generally available in this country, as they are mostly too rapid in their character.

Steeping in Pits.—In the absence of suitable streams, recourse is had to a mode of steeping in pits or pools sunk in the ground. But so many favourable conditions are required to be obtained, and so many unfavourable ones to be avoided, in the selection of the site for the pool, and the supply of water required, that it is probable that a desirable or perfect steep-pool could not be formed in any part of the country. The soil forming the bottom and sides of the pit will have an influence on the colour of the fibre; clay, gravel, alluvial and peaty soil, will each impart some peculiar dye to the material, which more or less affects its value. The water used in the pit or pool must not be spring water, and it must not have flowed over any soil containing metallic deposits; and rain water is not well calculated for the purpose. But in addition to all these difficulties, attendant upon obtaining the requisite means, the grower of flax has to contend against all the uncertainties and risk of either over or under-steeping his flax. "One sultry night," says one of the reports of the Royal Flax Society, "while it is in the steep, and nearly rotted sufficiently, is enough to carry the fermentation beyond the safe point. So much is this feared by farmers, that almost all flax is underwatered; and although much of it is afterwards mannered on the grass, yet the great proportion of it is brought to market with the shoves still unseparated in bits on the fibre." But while the sultry nights of summer are unfavourable to the steeping of flax, and inconvenient to the farmer, inasmuch as his labourers are at that season generally otherwise employed, it is also obvious that during the winter, when comparatively little farm labour is carried on, the process of steeping must be discontinued altogether, in consequence of the temperature.

Schenck's System.—A fourth process has, within the last few years, been very strenuously advocated by the Royal Flax Society in Ireland, which consists in steeping the flax in hot water. This mode, although doubtless an improvement upon any of the existing plans, still does not afford the means of obtaining that complete separation of the fibres which it is desirable to obtain.

This plan is more favourably described by Mr. Seymour, who says—"This mode of hot-water steeping is, doubtless a very great improvement, and has been found by Messrs. Marshall, of Leeds, and other eminent manufacturers, to be most efficacious in effecting a perfect separation of the fibre. But to its adoption by the farmer there are two great obstacles, viz., the necessity, first of superior skill, and secondly, of a considerable outlay."

At pp. 33–5, vol. ix, the advantages of Schenck's process are described by Professor Calvert, who shows that its rapidity and certainty afford au important economy. The objection as to the outlay required to erect the hot water tanks and apparatus is met by the Flax Society by a proposition to employ middlemen (known as "factors" on the continent), of which there will be one in each district, who would erect the necessary apparatus, and purchase from the farmers the raw material which he would prepare for market. On this plan Mr. Seymour expends a vast amount of indignation, although we do not think his logie by any means equals his eloquence. It is presumed that it would be necessary to give a "factor" a guarantee to supply him with a due quantity of flax, and Mr. Seymour doubts whether such a guarantee would be given by the farmers, or whether, when given, they would abide by it. In his own words—"to day or to-morrow large tracts may be sown with flax seed, but who can say this disposition will continue, that the farmer may not tire of it, that a thousand causes may not render the speculation abortive, and so the capital expended on the buildings and machinery be lost?" This line of argument does not agree with the £30 per acre profit, which the farmer is to obtain by growing flax, and it may be fairly inferred, that if a good profit can be made by growing it, it *will* be grown, no matter whether the buyer is called a "factor" or a "manufacturer." But Mr. Seymour has a still graver objection—"It creates a monopoly," "in aiming to secure a division of labour, it sacrifices competition." And what is Mr. Seymour's alternative, do our readers suppose? A company of manufacturers! Why one capitalist should be a more dangerous monopolist than a dozen combined together in a company, we cannot conceive. Our experience of the working of companies does not lead us to coincide in the following supposition:—"a company of manufacturers, who, it may be observed, would be ever quick to employ the best processes, and could more readily become possessed of them, instead of checking competition, would, of necessity, increase it; their success would soon bring other companies into the field, &c." Without a doubt, but Mr. Schenck has as much right to his patent as Mr. Claussen has to his, and we should like to see both have fair play. If, as Mr. Seymour so confidently asserts, Schenck's system is bad, it will not bear the competition of Mr. Claussen's friends; if it be good, it deserves to succeed. In either case the farmer will benefit by the competition.

The remedy proposed by Mr. Claussen to obviate the difficulty of carriage, is for the farmer to roughly dress or thrash the flax, on the spot where it is grown, so as to deprive it of a portion of the woody part of the plant. This will have the effect of diminishing its bulk, and so of saving carriage, and will also return an additional quantity of manure to the soil.

Presuming, then, that the market can be economically reached, we are brought to the grand point,—Can a permanent extension of the demand for flax be relied on? Should Mr. Claussen's flax eotton fulfil but a part only of the sanguine anticipations which are formed regarding it, it will prove of immense importance to our manufacturing interest. Its application to cotton machinery would at once enlarge the field from which Lancashire draws its supplies of the raw material; but of this more anon. For the present, we will only quote the Chevalier's process for making flax-cotton.

Preparation of Flax Cotton.—The principle of the invention by which flax is adapted for spinning upon cotton, wool, and silk, independent

of flax machinery, consists in destroying the cylindrical or tubular character of the fibre, by means of carbonic or other gas, the action of which splits the tubes into a number of ribbon-like filaments, solid in character and of a gravity less than cotton, the upper and under surfaces of which are segments of circles, and the sides of which are ragged and serrated. In order to explain the nature of the process by which this change is effected, it is necessary first to explain the structure of the flax plant. The stem of the plant consists of three parts; the shove or wood, the pure fibre, and the gum resin or glutinous matter which causes the fibres to adhere together. In the preparation of the plant for any purpose of fine manufacture, it is necessary first to separate from the pure fibre both the woody part and the glutinous substance. The former of these may be removed by mechanical means, previously referred to, almost as simple as those employed in the threshing of wheat. In order, however, to remove the glutinous substance from the fibre, recourse must be had either to the fermentation produced in the steeping process or to some other chemical agent. The present system of steeping in water, whether cold or hot, is, however, ineffectual for the complete removal of the glutinous substances adhering to the fibres, a large per centage of which is insoluble in water. The first process, therefore, which it is necessary to adopt in the preparation of flax cotton, is to obtain a perfect and complete disintegration of the fibres from each other, by the entire removal of the substance which binds them together.

This is effected by boiling the flax for about three hours, either in the state in which it comes from the field, or in a partially cleaned condition, in water containing about one half per cent. of caustic soda. After undergoing this process, the flax is placed in water, slightly acidulated with sulphuric acid; the proportions of acid used being 1 to 500 of water. Any objections urged against the employment of such substances, even in the small proportions above stated, are at once met by the fact, that the soda present in the straw, after the first process, neutralizes the whole of the acid, and forms a neutral salt, known as sulphate of soda. This process, producing as it does a complete separation of the integral fibres from each other, is equally adapted for the preparation of long fibre for the linen, or of short fibre for the other branches of textile manufacture. When required to be prepared for linen, all that is necessary after the above process, is to dry and scutch it in the ordinary modes. The advantages which this mode of preparation possesses over any other mode in use, are stated in the official report of the proceedings at the Royal Agricultural Society to be the following :—

"1. That the preparation of long fibre for scutching is effected in less than one day, and is always uniform in strength, and entirely free from colour, much facilitating the after-process of bleaching, either in yarns or in cloth.

"2. That it can be also bleached in the straw at very little additional expense of time or money.

"3. That the former tedious and uncertain modes of steeping are superseded by one perfectly certain with ordinary care.

"4. That in consequence of a more complete severance of the fibres from each other, and also from the bark and boon, the process of scutching is effected with half the labour employed."

Complete, however, as may be the separation produced by this mode of treatment, the fibres, from their tubular and cylindrical character, are still adapted only for the linen or present flax manufactures, as their comparatively harsh and elastic character unfits them for spinning on the ordinary cotton or woollen machinery. At this stage, therefore, it is that the most important part of the invention is brought into operation. The flax, either before or after undergoing the processes required for the severance of the fibres, is cut by a suitable machine into the required lengths, and saturated in a solution of sesqui-carbonate of soda (common soda) a sufficient length of time to allow of the liquid entering into and permeating by capillary attraction every part of the small tubes. When sufficiently saturated, the fibres are taken out, immersed in a solution of dilute sulphuric acid of the strength of about one part to two hundred parts of water. The action of the acid on the soda contained in the tube, liberates the carbonic gas which it contains; the expansive power of which causes the fibres to split, and produces the result above described. The fibre is then bleached, and after having been dried, and carded in the same manner as cotton, is fit for being spun upon the ordinary cotton or woollen machinery.

(To be continued.)

COTTON AND ITS MANUFACTURING MECHANISM.

By Robert Scott Burn, M.E., Mem. S.A.

(Continued from page 278, Vol. IX.)

The cotton plants are of the order Malvaceæ, the common mallow being the type of the order. The genus Gossypium is that which produces cotton; it comprises, according to Linnæus five, Lamarck eight, and Cavanilles and Wildenow ten species; they are all natives of intertropical climates, and are indigenous in India and America. The species have numerous varieties, these depending chiefly on the various systems of cultivation, but are also occasioned by variations in the climate, soil, or locality. The great distinctions of the species are Herbaceous cotton, Shrub cotton, Tree cotton. The first of these being the most useful, we shall alone notice. It is the most generally cultivated; its botanical name is Gossypium herbaceum. The plant is annual, its average height being twenty inches; the leaves are of a darkish green, having their surface marked with brown veins; each leaf is divided into five lobes. The flower is of a pale yellow colour, resembling that of the mallow; it has five petals, and each marked with a purple spot at the base. A capsular pod appears on the flower falling off, and is supported by three triangular leaves, with deep indentations at their edges; the pod itself is somewhat triangular in shape, divided into three cells, and of the size of a walnut. The wool expanding as the pod ripens, causes it to burst, when it is exposed to view, a ball of either yellowish or snow-white down. This ball of down is formed of three locks, one to each cell, enclosing and adhering to the seeds; these are like the seeds of grapes, but of much larger size. "A field of cotton at the gathering season, when the globes of snowy wool are seen among the glossy dark green leaves, is singularly beautiful, and in the hottest countries, where the yellow blossom or flower and the ripened fruit are seen at the same time, the beauty of the plantation is of course still more remarkable." Forbes thus describes the appearance of the cotton plantation in Guzzerat (see his "*Oriental Memoirs*"):—"The cotton bushes put forth a beautiful yellow flower, with a crimson eye in each petal; this is succeeded by a green pod, filled with a white stringy pulp; the pod turns brown and hard as it ripens, and then separates into two or three divisions, containing the cotton. A luxuriant field, exhibiting at the same time the expanding blossom, the bursting capsule, and the snowy flakes of ripe cotton, is one of the most beautiful objects in the agriculture of Hindostan." The most valuable cotton is that called "Sea Island;" it is chiefly cultivated on the low sandy islands and plains near the coast of Georgia and South Carolina; the islands consist of salt marsh and land of a gray rich soil. The cotton produced is of a superior quality, and is in much demand. The high price obtained for this quality of cotton has caused the Americans for many years to pay great attention to its cultivation. The staple of sea island cotton is strong and silky, and much longer in the fibre than that of any other description. The short stapled cotton of America, known as Bowed, or Upland Georgia, is produced in immense quantities. Cotton has long been imported from the East Indies, and it is only the want of roads and internal communication that has prevented our having an adequate supply from that source. The subject of developing the resources of India by constructing roads and introducing steam navigation, has been so fully investigated in this Journal, that we need only now refer our readers to the articles under this head. The ensuing session will witness a discussion on the fruits of our Indian policy in reference to the renewal of the East India Company's charter, which cannot fail to awaken public attention.

Cotton of an excellent quality began to be imported from Egypt about 1823, when its cultivation was commenced by the celebrated Mehemet Ali. The cotton from the West Indies has long been imported

into this country in large quantities; in the eighteenth century the largest supplies came from there and from South America. Brazilian cotton was first imported in 1781 from Maranham; the Pernambuco was found shortly afterwards to be of finer quality than that of Demerara; it was consequently much in demand, and, generally, it fetches a price only inferior to that of sea island cotton.

The value of cotton for manufacturing purposes depends on the quality of its fibre, or, to use the technical expression of the trade, the "staple." This depends on its length, strength, and fineness. The two distinctions in the trade as regards the various kinds of cotton used are "the long stapled," comprising under this the Sea island, Brazilian, West Indian, and Egyptian cottons; and "the short stapled," those cottons so called being the upland or bowed cotton of America, Orleans, Mobile, and the Surat. It was formerly the practice to use a certain kind of cotton for a particular species of "fine counts" manufacture. This is rarely ever done now, excepting in the case of mixing a portion of one kind with that of another. The manufacturer may prepare a mixture for spinning, which will serve for a substitute of any kind of cotton with the exception of the most superior quality. In a cotton manufacturing district, it is no rare thing to hear the complaints of the operatives as to the "mixing" department of certain mills, in which reference is made to the credit of the manufacturer in preparing a mixture which is more remarkable for its ingenious composition of "poor stuffs," than for its capability of being easily worked up by the machines into good materials.

The operation of gathering the cotton is one which demands considerable care and attention. The pods are not all sufficiently ripened at the same time, to admit of the plants being reaped at once; several visits to a cotton field are thus necessitated. The best time for picking the cotton is in fine weather, a few days after the pod has opened; wet and damp weather for gathering is carefully to be avoided, as the cotton would become mouldy, and the oil of the seed spread and discolour the wool. In order that the wool, as it is termed, be thoroughly dried, it is spread out in the sun on a platform of tiles, and allowed to remain for several days; the wool and seeds becoming then very dry, the latter are more easily separated from the former.

The next operation is one of some difficulty, namely, separating the seeds from the wool. In India this is effected in some instances in a very rude manner, thus; the cotton and seeds are placed upon a smooth stone, an iron roller is placed upon the cotton, and worked backwards and forwards by the wooden soles of the women who are employed in the operation. The "roller gin" is a simple machine, thus constructed: two rollers are placed parallel to each other, revolving in different directions; in some cases two persons are employed in working the rollers, one at each; in others they are actuated by cranks and treddles; the rollers are fluted in their peripheries, and revolve at a little distance from each other. The cotton seeds are supplied at one side of the rollers, the wool passes through, drawn between the rollers by their rotation, but the seeds being larger cannot pass through, they are, therefore, separated and fall down. An expert operator cannot clear much more than fifty pounds a day by this machine. The invention of the "saw gin," as it is termed, by Mr. Eli Whitney, of Massachusetts, United States, in 1793, introduced a new era in the history of the cotton trade; without this expeditious machine it has been remarked that the 'cotton Manufacture could not have attained its present extension." The following diagram and description will illustrate the principle of action of the "saw gin."

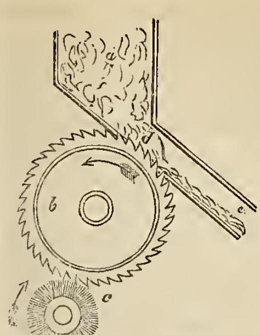


Fig. 1.

The cotton is put into a receiver or hopper, *a*, fig. 1; the side on which the cotton rests is composed of a series of iron bars or rods, about one-eighth of an inch apart, and running longitudinally; beneath this grating, a wooden roller, *b*, revolves; circular saws are placed on the axis of this, and are separated by a wooden packing, about one inch and a half thick; a series of projecting saws, one inch and a half apart, are thus presented along the wooden roller, the teeth of these are allowed to project within the hopper or receiver, between the bars of the grating as shown at *d*. On the roller, *b*, being turned in the direction of the arrow, the teeth of the saws take hold of the cotton wool and drag it through from between the bars; but the seeds, from their greater size, are prevented from following, and are therefore projected down the hopper, and passed out at *e*; the cotton adhering to the teeth of the saw is taken off by the brush, *c*, rotating in the direction shown by the arrow. The British saw gin, wholly composed of iron, with the exception of the front board, is considered an improvement on the American machine. "Its entire weight is about 20 cwt., the heavest section being about 150 lbs. It may be worked by two or more horses or bullocks. The space whieh it occupies is about 6 feet square. If worked by four horses or bullocks during 18 hours (say each pair for 9 hours), it is stated to clean fully 20 cwt.; but if we reckon $3\frac{1}{4}$ lbs. of seed cotton per saw per hour, 60 saws will clean nearly 200 lbs. per hour, or we may estimate 3,000 to 3,500 lbs., if worked continually for 18 hours, yielding from 20 to 30 per cent. of clean cotton according to quality." With reference to the per centage of clean cotton obtained from the pods of various kinds, it is stated that American will produce 30 per cent., East India from 20 to 25 per cent.

As before noticed, the cotton of India, and its more extended cultivation for the supply of our home market, has of late attracted much attention in high quarters. With a view of practically assisting the native cultivators in preparing clean and good cotton for export to this coun-

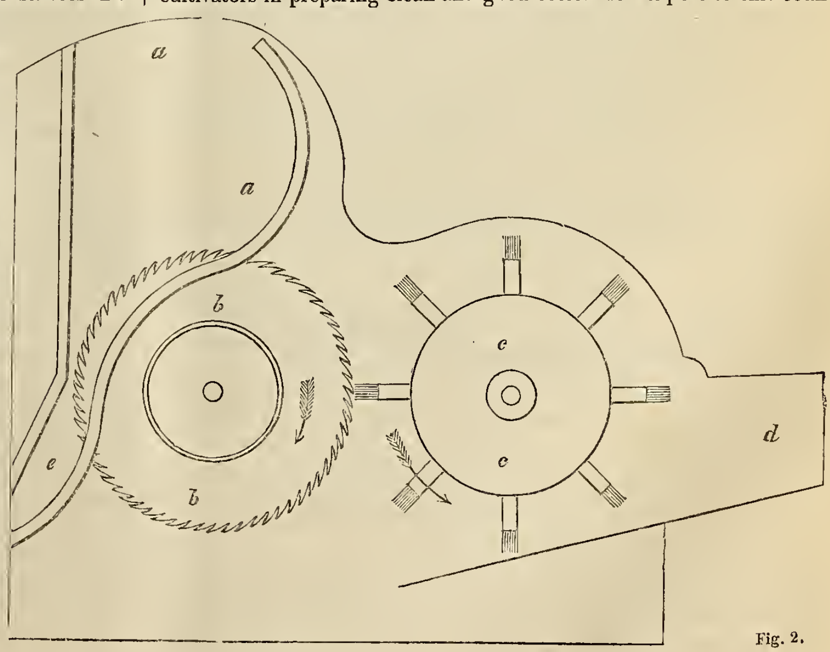


Fig. 2.

try, the East India Company have sent out considerahle numbers of a cheap, simple, and efficacious modification of the "saw gin." It is termed the "cottage saw gin," and was, we believe, introduced to the notice of the Hon. East Indian Company by the Manchester Commercial Association, the gentlemen composing which, have all along taken a great interest in everything likely to improve the export trade of Indian cotton.

In fig 2 we give a sectional diagram of the machine. *a a* is the receiver into which the cotton seed and wool are placed; *b*, the saw; *c*, the rotating brush, which takes off the wool from the teeth of the saw, and delivers it to *d*; the seeds, when separated from the wool, pass down the shoot to *e*. There appears to be no doubt whatever on the point, that the introduction of eheap and efficient cotton-cleaning machines into India will confer a vast benefit on native cultivators, and will do much to increase—and this very rapidly—the export of cotton wool from that country. With reference to the American trade, it has been truly remarked, "that the secret regarding the rapid extension of the cotton cultivation of America lies in the early introduction and extensive use of her cleaning machinery. Without the saw gin, the southern States of America, notwithstanding their millions of slaves, would at the present moment he unable to find labour to clean their yearly crop of cotton. Whitney's invention has been to America what Arkwright's was to this country. The saw gin is now taking firm root in India; and the suceessful introduction of it there may be looked upon as one of the most hopeful movements towards an improved quality and increased importation from that country." It may be interesting to note the effect which the introduction of Whitney's saw gin into practice, had upon the extension of the cotton export trade from that country. The exports of American grown cotton in 1770 amounted to only "7 bags and 3 barrels;" from 1785 to 1790, the average yearly export was 240 bales; in 1794, the year of the introduction of the saw gin, the export had increased to 5,340 bales; in 1807, this amount had increased to 137,018 bales; and the last year, to nearly two millions and a half bales. Cotton cleaned by the saw gin is of greater marketable value than that cleaned by the roller gin; nevertheless, the former is possessed of some disadvantages which may be briefly noticed here. The action of the teeth of the saw gin is rather a violent one, roughly tearing the fibres from the seeds; the quality of the fibre is thus in some measure deteriorated. Again, the teeth in some cases detach motes from the seeds, which, passing through the grating, mix with the wool, thus necessitating additional future labour in the factory, to render it fit in every respect for drawing and opening into thread for weaving purposes. The teeth of the saw, moreover, are apt to get speedily out of repair, from coming in eontaet with sand, stones, and other extraneous matter which is generally found in cotton, being allowed through carelessness to hecome mixed therewith; the teeth thus rendered torn or jagged, increase the tearing action of the machine, and still further tend to destroy the staple of the cotton wool. Such are said to be the disadvantages of the "saw gin" by the inventor of the "patent cotton gin," Mr. F. A. Calvert, of Cannon-street, Manchester—a machine which is very highly spoken of, and likely to become generally used. The principal feature of this machine is the employment of a roller, having serrated steel blades, recessed or let into its surface. The action of this roller, in conjunction with other simple appliances shortly to be noticed, is that of a gentle combing, rather than a sawing or tearing roughly asunder of the cotton from the seed, as in the saw gin.

(To be continued.)

SELF-INKING STAMPING PRESS,

BY M. GUILLAUME.

Illustrated by Plate 3.

In various departments of public business, as well as in the counting-houses of private firms, it is customary to employ ink stamps for stamping papers, for various purposes. Amongst these may be enumerated the obliterating stamps upon the postage "Queen's heads," and identifying stamps on the letters themselves. A still greater demand has sprung up from the increasing use of adhesive envelopes, on which the old-fashioned seal or wafer is replaeed hy a medallion containing the name and address of the firm by whom it is sent. Or, if the wafer or seal be still preferred for security, the same end may be attained by a stamp in the corner of the envelope. These systems have the advantage of identifying the letters and facilitating business; as, for example, in the absence of a principal, instructions may be left, "all letters from Messrs. A. B. are to be opened—those from B. C. are to be forwarded," &c. The post-office authorities also find it a great saving of trouble, so much so, as to consider it worthy of a special regulation; for, as an almost incredible number of letters containing a still more incredible quantity of money and other valuables are aunually returned to the senders through the dead-letter office, owing to the inability of the postmen to discover the persons to whom they are addressed, the trouble of opening and re-directing all these letters is saved to the post-office by this system, the identifying stamp being a sufficient re-direction.

The stamping apparatus usually employed consists of a stamp, furnished with a handle, and a small inking table, on which the stamp is pressed before being applied to the paper. This process is both slow and imperfect, as the ink is rarely evenly spread, nor can the blow be given by hand with the requisite precision. Various machines have been designed to effect the desired end, which we propose to notice, and the most complete we have yet seen is that constructed by M. Guillaume, machine-maker, of Paris, of which we have given an engraving.

The machine is fixed upon a table at a convenient height, at which the operator sits, and which serves to contain the letters and papers to be stamped. Motion is communicated to the machine by a pedal, worked by the foot of the operator, and the ink is supplied by inking rollers, as in the ordinary printing machine.

Fig. 1 is an elevation, aud fig. 2 a plan—both in section.

a a, is the table forming the base of the machine, to which are fixed the four columns carrying the top frame, *b*. This frame supports the bearings of the beam, *c*, one end of which is connected by links to the stamping plunger, *d*, working in guides fixed to the front pair of columns, whilst the other end is connected through the link, *e*, to the lever, *f f*, working on the fixed centre, *g*. At the other end of the lever, *f f*, is the rod, *h*, connected to the pedal, fixed in the frame of the table below, which gives motion to the machine.

When the foot of the operator depresses the pedal and the rod *h*, the plunger *d*, and the stamp *i*, will descend on the paper placed to receive it. Its ascent is provided for by the spring *k*, which is fixed at one end to the lever *f*, and at the other to a link *m*, suspended from a fixed point above. This spring is bent when the pedal is depressed, and its reaction, when the operator's foot is removed, brings the machine back to the position shown in the drawing. Its rigidity can he adjusted by means of a screw at the extremity.

We have now to see how the ink is supplied to the stamp. The beam *c*, has an arm *n*, carrying at its lower extremity, a frame *o*, adjustable in height, and fixed by means of set screws. This frame carries the plates of steel *p*, *p*, which are bent over at each extremity, and clip the spindles of the inking rollers, *r*, *r*, and *s*. These rollers thus move in the arc of a circle described by the arm *n*, as shown by the dotted lines, and roll on the inking table *t*, which is formed of a corresponding curve; *u* is the ductor roller, which revolves in contact with the reservoir of ink *v*. The roller *r*, in its motion backwards, passes over the ductor *v*, and receives from it a portion of ink, which it distributes over the table *t*; the distribution is assisted by the roller *r*, and finally the ink is taken off the table by the inking roller *s*, which, when the stamp *i*, rises, passes under it and inks it, ready for its descent upon the paper.

The plates, p, p, from their construction, give the inking rollers the due elasticity to enable them to spread the ink perfectly.

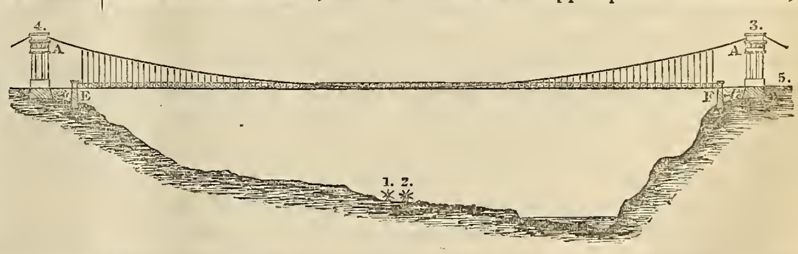
The ink reservoir, v, moves on a centre and is kept up to the ductor roller by means of two set screws at the back, x, x. The ductor roller itself is moved by means of a ratchet wheel at one end of the spindle, to which motion is communicated by the link y, and the pall z, at every stroke of the lever f.

From this description our readers will have no difficulty in following the motion of the machine. When the operator releases the pedal, the stamp rises and the ink rollers come forward, and the stamp is inked. The paper is then placed under the stamp, the pedal depressed, and the rollers return for a fresh supply of ink. In the engraving two ink reservoirs are shown, and the rollers are divided longitudinally, so that two different inks, such as red and black, might be simultaneously used, one for one side, and the other for the other side of the paper, if desired.

FREIBURG SUSPENSION BRIDGE.*

With respect to proportions, this is the bridge of the greatest span hitherto erected; it is suspended highest in the air, occupied a moderate time in erecting, and incurred but a small expense. It was built in consequence of the natural difficulties which prevented the town of Freiburg receiving many visits, commercial and otherwise, which it has done since this means of communication was formed. Freiburg stands on the sloping side of a hill, which is separated from its neighbouring height by an intervening valley between two and three hundred feet deep, and called, because of the little river which winds through it, the valley of the Sarine; across this valley lay the road connecting Freiburg with the German frontier, and the ascent of the hill was made by a twisting and difficult way, presenting some very steep inclines. In 1830, a French engineer, M. Chaley, proposed to erect a wire cable bridge reaching from one hill to the other, a distance of nearly 900 feet at the spot pointed out. After pecuniary agreements, this engineer proceeded with the work on the plan he offered, which was to erect a bridge capable of bearing passenger and goods traffic; two towers were to be built on each hill side, at a distance from each other of 870 feet, between which four wire cables, two on each side of the roadway, were to be stretched, giving a curve 63 feet deep in the middle, suspending the roadway 167 feet above the level of the river.

The general appearance of the bridge may be conjectured from the accompanying figure, and the details of its construction will receive illustration from the partial diagrams; a description of such a structure must necessarily be somewhat long, but it is very instructive, since the bridge is a model of its kind; to give it as clearly as we may, it will be advisable to divide the explanation according to the several parts constituting the bridge. 1st. The main cables and the manufacture. 2nd. The mooring cables. 3rd. The masonry above and below ground. 4th. Raising and fixing the cables, and arrangement of the roadway.



The main Suspension Cables.—These most important elements of the bridge are composed of iron wire 0.12, or little more than one-tenth of an inch in diameter, a lineal yard of which weighs nearly two ounces. Each cable (made up of 1,056 lines of wire), is $5\frac{1}{2}$ inches in diameter, and 1,228 feet long, being bound up into a cylindrical form by iron wire at every second foot of its length. The wire was supplied in coils of 18 or 20 lbs. each, and if found to be good, passed through an introductory process of boiling in a mixture of linseed oil, litharge, and soot; the wire was then hung up to dry. This was intended to preserve the wire from rusting. The lengths of wire, after the preceding treatment, were rolled on reels above a foot in diameter, and when one length had been wound on, the workman twisted the remaining end with the extremity of another length, tightly binding the two with annealed wire; so well was this junction effected that on testing the part it never gave way before some other part of the wire broke. On account of the great weight of a complete cable, and the difficulty of raising it to so great an elevation, it was made in parts called strands, which could be separately raised: they were twenty in number for each cable, and themselves consisted, twelve of them of 56 wires each and eight of 48 wires. To manufacture one strand, a walk or level line was chosen 614 feet long for want of a longer, which being just half the length of the strand the wires had to be carried twice along the walk. At one end were firmly fixed two blocks of oak, to which were hooked iron stirrups; an end of wire on the reel being fastened to one block, was passed round the stirrup, and the reel carried to the other end of the walk, where the wire was tried by a weight of 220 lbs., and sustaining the proof, it was passed round a semi-cylindrical block also firmly fixed and then borne to the point whence it started, and was placed round the second stirrup; this length was also tried by the test weight and the movement continued until one strand, or 56 threads, had been unwound from the reels, when the end thus arrived at and the end at first fixed to the block were bound together; the whole bundle was also bound at each end and every three or four feet of length. A coating of the preservative mixture before mentioned was now applied and the prepared strand laid aside. Five of these strands were made in a week by as many workmen.

Mooring Cables.—These were intended to take the ends of each suspension cable, when it passed through the sloping gallery, G (fig 2), and constitute the final attachment to the heavy masonry. They were made in a manner similar to the former, but thicker, and when taken off the stirrups on which they had been wound, in consequence of elastic force, they twisted and curled up like a corkscrew; to obviate this difficulty, series of laths were bound round the cable before loosing it, and little of the former effect followed. Great care was taken to bring all wires composing these cables into equal tension. They were each four inches in diameter, and composed of 528 wires.

The Masonry.—Each pier is founded on the rock, is $66\frac{1}{4}$ feet high above the road level, and gracefully arranged as a Doric portico. They present an arched opening 43 feet high to the passenger, each of the sides bearing three pilasters and an entablature. Jura limestone faces the basement courses, but the interior and upper parts are sandstone, finely dressed, so as to allow of no vacant spaces in the stone-work. The latter material was readily obtained, as it constitutes the mountain masses on each side of the valley; when first quarried, it was found to be easy in working, but afterwards dried and became hard. On proving its strength by an hydrostatic press, it bore 555 lbs. per square inch of surface without injury. In the upper part of the piers, apparatus was placed for accommodating the chains; it consists of three rollers, giving as many points of support to the cable, A, which is allowed to spread out and form a band at these points. Every facility is afforded by these friction rollers for slight movements of the cables in consequence of

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* From Warr's *Dynamics, &c.* London: R. Baldwin.

changing temperature or similarly acting agents, while, by their disposition, the cables are not damaged by sudden bends.

Those portions of the masonry which may be called underground, are the sloping galleries, G, through which the cables pass, and are connected with the mooring chains and the vertical mooring shafts, H; the former were excavations six and a half feet square, roofed with limestone arches. The mooring shafts, H, commence at the lower extremity of the galleries, and are cut in the solid rock, R, to a depth of 52½ feet; they are also 10 feet broad, 3 feet 3 inches wide, and four in number. In them was fitted the masonry, M, intended to bear all the weight from the cable, and for this all important purpose it was admirably arranged. Angular incisions were made in the rock at three places, which were subsequently filled with stone-work of a dovetail form, and having all the peculiar excellency of that description of joint; the mooring cables, B, which were carried through this filling in, had thus a most secure abutment at the lower part. A small passage, P, about six feet high, extends under the cable fastenings, to facilitate their inspection, communicating with the ground surface by an horizontal gallery, cut from the hill side—a distance of nearly 350 feet. Limestone supplied the material for these mooring shafts, and was obtained from the quarries of Neuville and Lengnau, situated on an inferior branch of the Jura mountain chain, about 30 miles from Freiburg; on being tried similarly to the sandstone, it was found to be capable of bearing 3,307 lbs. on the superficial square inch without injury.

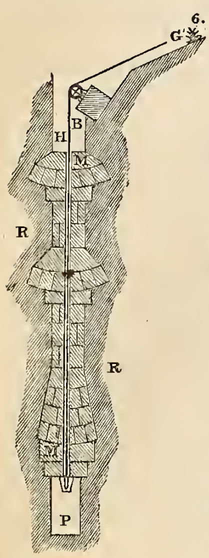


Fig. 2.

Raising the Cables.—When every preliminary arrangement had been made, and all the stone work secure, two windlasses were placed on each tower, one at each point; two midway between them down in the valley, and one in each sloping gallery. Round No. 5 a hempen rope, an inch in diameter, was wound, thence it passed twice round the axles of the windlasses No. 3, on the tower, and descended towards the valley, being joined to another smaller rope, which reached windlass No. 2, the same being done on the other side. A drum, six feet and a-half in diameter, bearing one strand, wound not as usual, but beginning from the middle, so as to leave both ends on the same side, was then placed between the windlasses 1 and 2, and an end of the strand attached to each rope; this was followed by a working of the windlasses 3 and 4 at both piers, and the small cable gradually unwound and rose in the air towards its intended location; when the ends had reached the towers, one side ceased to work, while the workmen on the other side drew their end over temporary rollers on the top of the pier, and attached it to a rope from windlass No. 6, in the sloping gallery, which, on being worked, drew the strand over permanent friction rollers on the pier, and brought its end into the sloping gallery. Workmen at the other end of the bridge wrought similarly, and brought up this first strand to a proper curvature. To determine this properly, two logs or bench-marks had been fixed at each side against the piers, the line of sight between which formed the appointed level for the roadway, and at it was intended that the cables should descend to this level, it was determined with tolerable accuracy by drawing the strand until the lowest point of its curve touched this line of sight. Mooring cables were now brought down the galleries, and drawn down the shaft through its small opening by a windlass worked rope. When this cable was secured, in the manner shown in fig. 2, it was ready to take hold of the suspended strand; but the latter was not attached until another strand was raised, when one of them was placed on each side of the mooring cable, and a connecting bolt passed through the stirrups attached to them. This process was continued until forty strands were drawn up on each side of the bridge, forming a pair of bands, each above two and a-half feet broad, and about 30½ feet apart; they were divided each into two bundles, A A (fig. 3.), of 20 strands, and bound up in a cylindrical shape by iron wire, leaving those parts which rest on the pier friction rollers as a band. The work of attaching the suspension cords, S, now followed; they are composed of 30 wires, making a diameter of one inch; their greatest length is about 54 feet, and least 6 inches; each end is bent round a stirrup, *s s*, to afford means for suspension, in a manner shown by the diagram; a hook-loop catches the lower stirrup, and takes in its loop one end of a road-beam, D; the upper stirrup embraces a saddle, *e*, which also embraces the pair of cables, A A. A distance of 4 feet 11 inches separates the suspension ropes.

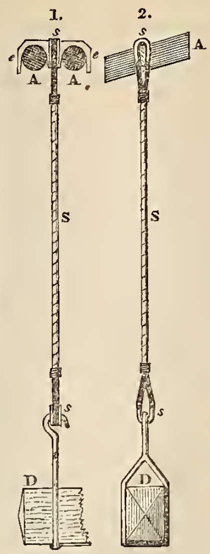


Fig. 3.

When these had been distributed on each side of the bridge, and the suspended beams placed between them, longitudinal planking was laid on the cross-beams D, with another layer of cross-planks, which form the carriage-way. The footpaths are raised about 7 inches above the carriage-way, and are very narrow, being not more than 2 feet 9½ inches wide, while the carriage-way takes up 15 feet 5 inches, making the total width between the railings 21 feet. The total deflection of the bridge, when completed, was 63¼ feet, and its length 870¼ feet, which gives the proportion for the deflection 1-13¾ths greater than the most advantageous ratio, which has been stated to be about 1-15th. The platform hangs 167⅓ feet above the river Sarine, immediately below it. The following is a summary of the dimensions of its principal parts:—

	Ft.	Inches.
Length of suspended roadway (E, F, Fig. 1.) ..	807	0
Deflection of the main cables	63	3
Height of roadway above the river Sarine	167	4
Rise of platform in middle	1	8
Main cables of 1,056 threads each, diameter.. ..		5.5
Iron wire, diameter		0.12
Width of roadway	21	0
Total suspended weight	296 tons.	

Altogether, Freiburg suspension bridge must be considered as a noble specimen of its kind; its elegant simplicity accords with the locality and scenery; its great span and comparative lightness are most striking to the eye and reason; and its scientific disposition is very instructive. The cost of this bridge was £24,000, or one-fifth the expense of the Menai bridge, which is 300 feet less in span.

FRENCH *VERSUS* ENGLISH FLOUR MILLS.—WESTRUP'S PATENT CONICAL FLOUR MILL.

Illustrated by Plate 3.

In our last number we made some remarks on the superiority of French over English flour, which appeared to warrant the assertion that the French machinery was superior to that of our own engineers. There is, however, another cause which we then omitted to mention, which will help to account for the difference between French and English bread. In France only two qualities of bread are made, the white and the brown, so that the miller's object there is only to produce a small quantity of the very finest flour, without respect to any "seconds"

flour. This would not pay the English miller, because the very slight increase of price which he would obtain for the fine flour, would not compensate him for the loss on the "seconds." As regards the mechanical part of the question, there is an important difference between the French and English systems, the former making a pair of stones do only half the work of the latter in a given time, a system under which the English miller would only turn out half the work he now does, were he inclined to try the experiment. The French system may be described as gently rubbing off the skin of the wheat, whilst the English system cuts up the bran into fine particles, which cannot afterwards be perfectly separated from the fine flour.

Having premised thus much, we will endeavour to show in what respects the mechanical construction of the ordinary grinding apparatus is defective. The object is to burst the skin of the wheat, to rub the bran clean of flour, and then to deliver it from the stones, to make room for a fresh supply of wheat. The two first operations are performed efficiently by an ordinary pair of stones, but the imperfect manner in which they perform the third operation, the getting rid of the flour, causes serious evils. Taking the case of a pair of four feet stones, it is obvious that all the flour ground within a radius of 15 inches, is *re-ground* whilst passing over the remaining 9, which are moving at an accelerated velocity. As the greater part of the wheat is ground within the smaller radius, there is not only a great loss of power in forcing the flour through the remaining distance, but the quality of the flour is deteriorated by the friction and consequent heating to which it is subject.

One method of removing this evil has been in use on the continent for some time, and more lately, also, in England, that of blowing air in at the eye or centre of the upper stone, which has the effect of assisting the delivery of the flour, and also of keeping it cool. This plan is about to be carried out on a large scale in London, and we shall detail it at some future time. At present we shall describe another alternative, the invention of Mr. Westrup, a practical miller, who has entirely remodelled the grinding apparatus, which has retained its primitive form for so many centuries.

In Mr. Westrup's system, the grinding surfaces are converted from flats into cones, so that the force of gravity is added to the centrifugal force, to assist in getting rid of the flour. Taking the view also, that the "real grinding" is effected near the centre of the stones, Mr. Westrup removes the outer edge (which, as we have seen, only *re-grinds* the flour), and so reduces the diameter from four feet to two feet six inches. But as a portion of the wheat escapes grinding, from the short time it is retained between the stones, that portion is passed through another pair of stones, whilst the flour is carried off by the means described below, and thus escapes re-grinding.

From experiments made on this mill by H. Smith, Esq., C.E., it is estimated that the two pairs of stones, arranged as described, will do twice as much work per hour as one pair of four feet stones, and require only the same power, thus reducing the cost of steam power 50 per cent. The report is as follows:—

"From these experiments I draw the following conclusions in favour of the Conical Flour Mill. First, as regards the produce; second, as regards the power required; third, as regards the advantages.

First, the loss in grinding is less, and the produce of the more valuable portions of the wheat is increased; that is, the husk of the clavel is more thoroughly deprived of the flour by the patent than by the ordinary method. The quality of the flour is also materially better by the patent plan, and being stronger, it makes a greater quantity of bread.

The Conical Mill also produces a flour from some of the cheaper wheats as strong as can be obtained from many of the dear foreign wheats, which is also a source of economy.

The bran is produced perfectly open and clean, and so much larger as to show that it, and consequently the flour, has not been so much destroyed by constant grinding as in the ordinary process.

Second, as regards the power. The ordinary work of a pair of 4 feet French stones is $3\frac{1}{2}$ bushels per hour, and the power required is 4 horses power.

But the Conical Flour Mill will grind nearly 7 bushels per hour, with only four horses power, so that there is a saving of nearly one-half of the cost of the steam power, fuel, and labour, usually employed; besides making a better article.

Third, as regards the advantages of the Conical Mill, independent of its economy.

The meal leaves the stones so cool, that it may be dressed at once, instead of waiting to become cool, as in the usual plan; an advantage of great value in practice.

The stones being only 2 feet 6 in diameter, and not weighing more than 6 cwt., and the ordinary pair of stones weighing 28 cwt., and being 4 feet in diameter, the new mill is more portable for country or export mills.

The arrangements for adjusting the relative distance of the stones from each other are much more complete than the usual mode, admitting of a nicety hitherto unknown.

The feed likewise is on a new and improved plan; being self-acting, it is easily adjusted, and cannot stop off: and the whole gear and tackle may be much lighter than on the old plan.

It is proper to say, in conclusion, that I consider the Patent Mill was severely tested by my trying it against one of the best ordinary mills I could find,—the Anchor Steam Flour Mills of Messrs. Pavitt, at Wapping, which are noted for their excellence. They are certainly superior to the average, and were in excellent working order; and the best pair of stones they had was chosen.

The power of the engines was taken by indicator diagrams in the usual way, and the most scrupulous care was observed in every stage of the process. Henry Smith, *C.E.*"

The plate represents a section of Mr. Westrup's mill, which we have inspected at his establishment, and which was constructed by Mr. Middleton, of Southwark. *a a* is a hollow vertical spindle, to which motion is communicated in the ordinary manner from the steam engine, by bevil gearing. To this shaft are fixed the upper and lower runners, *b* and *c*. The stationary stones, *d* and *e*, are fixed in cast-iron bed plates, which are fitted accurately to cast-iron curb plates, *g g* and *h h*, bolted to the framing. This arrangement is designed to facilitate the adjustment of the stones, which is effected in the following manner:—At four opposite points on the circumference of each curb are cast four short inclined planes, say six or seven inches in length, and similar inclines are cast on the cast-iron bed plate of the stone. If then the stone be turned round on its centre, it is obvious that it will either rise or fall, according to the direction in which it is turned. On a small portion of each curb a worm wheel is cast, into which takes a worm on each spindle, *s s*, to which motion is given by means of the hand wheels, *i i*, and the bevel wheels and spindles, as shown. In this manner, the distance between the stones can be adjusted to the utmost nicety, and their perfect concentric position maintained.

The feed is introduced, as shown by the arrows, through the feed pipe, *m*, and is adjusted in the following manner:—*n* is a tube, sliding over the feed pipe, and adjusted in height by the hand wheel, *o*; on the distance at which it stands from the revolving cup, *p*, depends the quantity of grain which is allowed to escape. Motion is given to *p* by means of the pulleys, *r r*, and the grain, from its centrifugal force, flies off, and passes, as shown by the arrows, between the upper pair of stones, *b*, *d*.

The product of the upper pair of stones then passes into the receiver, *t t*, which is covered with wire cloth, and provided with revolving

brushes, and thus forms a sort of dressing machine. The fine flour is dressed through the wire, and falls down outside, whilst the larger particles, not yet perfectly ground, pass through the lower pair of stones, *c*, *e*, into the receiver, *x*, to which a spout is attached. The flour from the dressing machine also falls through openings outside the curb, *h h*, into the same receiver. A revolving scraper, *y*, sweeps off the flour as it accumulates, and causes it to issue from the spout; after which it undergoes the usual process of dressing. The chamber containing the wire-gauze is surrounded with wooden shutters, *z*, *z*, to keep in the flour.

Mr. Westrup also proposes to use an air blast, which enters through a pipe at the top of the shaft, *a*, and through openings made in the shaft, into the annular space round the shaft, in the centre of the stones, *b* and *c*. Passages are cut in each stone, as shown, through which the air escapes at their grinding surfaces.

THE SMOKE QUESTION.

(Continued from p. 2.)

OF ARRANGEMENTS FOR COUNTERACTING THE IRREGULARITY OF HAND-FIRING.

It has been pointed out, that the carbonaceous particles forming opaque smoke may be inflamed by contact with red-hot fuel, or with any substance, such as fire-brick, at a sufficiently high temperature. Hence we have a number of plans for furnaces, which, though they may not entirely prevent the emission of smoke, yet do so to a greater or less extent, in proportion to the skill displayed in their construction. From the simplicity, economy, and non-liability to derangement of the plans based on this principle, they deserve careful attention, although their application in practice is attended with some difficulty, every case requiring some special arrangement to suit the requirements of various fuels, draughts, &c. Such matters are usually left to the discretion of the bricklayer, whose only aim is to get draught enough, or, in other words, steam enough.

Fire-brick, from its heat-resisting qualities, forms the most convenient material for lining furnaces; and its operation, as a smoke consumer, resembles that of a fly-wheel, as an equalizer of power. The fire-brick absorbs heat (as the fly-wheel absorbs power), and gives it out when it is wanted, to assist in raising the temperature of the smoke to the burning point. To describe any one method of arranging fire-brick work to attain the desired result, would only be misleading the reader, for it can only be acquired by experience.

One broad principle, however, remains to be stated, which will exercise a more important influence on the question of smoke consumption generally, than any other which experience has yet suggested. And this simply because it depends for success upon the exercise of an intelligence of the lowest possible order. In principle, it is founded on the old maxim, "Divide and conquer." We have already shown, that it is to regularity of combustion that we must look for smoke prevention, and the problem is, to counteract the irregularity of hand-firing. This is effected by dividing the ordinary furnace lengthwise, and *firing each half alternately*. Thus only half the fire is damped at a time by the charge of coal, and the high temperature of the other half ensures the combustion of the smoke. The fireman has merely to keep the bars free from clinker, and take care to fire one furnace whilst the other is perfectly free from smoke. There are no valves to regulate, and no moveable parts to wear or get out of order. It is obvious that this principle may be worked out in a variety of ways, several of which have been lately patented; but the system which appears to us to combine the two-fold advantages of good evaporative as well as smoke preventive powers, is that of

Messrs W. and J. Galloway's Patent Boilers—These boilers consist of a cylindrical shell or outer case, containing two cylindrical tubes forming the furnaces. These two tubes *unite behind the fire-bars* in a single chamber, and it is in this union that their virtue as smoke consumers consists. The ordinary double-furnaced boilers in use in the manufacturing districts are defective smoke consumers, inasmuch as the two furnace tubes extend the whole length of the boiler, so that the products of combustion do not meet until their temperature has been reduced below the point of ignition. Extended experience proves that, as economic evaporators, Messrs. Galloway's boilers hold a high rank, but this is a subject which we need not now discuss. It is sufficient for our present purpose that they are *not inferior* to any other class of boilers, and that efficiency need not be sacrificed in complying with the smoke prevention clauses of a sanitary act of parliament.

WORKING OF THE SMOKE ACT IN GLASGOW.

Our next chapter was proposed to be a summary of the facts we have thus briefly laid down, but we have just received a copy of a report on the subject, which deserves ample notice at our hands. It is entitled "*a Report on the state of Engine and other Furnaces used in manufacturing and other establishments in Glasgow, and on the means to prevent nuisance arising from Smoke.* Presented to the Municipal, Police, and Statute Labour Committee, by G. W. Muir. 1851."

The act of parliament referred to is the act 7 and 8, Geo. IV., cap. 43, entitled "An Act for forming a carriage road or drive round the park or public green of Glasgow; and for the better regulation of the fire-places and chimneys of steam engines and other works in the city and suburbs." We quote the following details of its provisions.

The limits within which it is applicable are, "the Royalty of Glasgow, or within two miles of the cross."

The parties subject to it are (section 21) "the proprietors or occupiers of all steam engines, or of works of which the machinery is moved by steam," and "the proprietors or occupiers of all other works, the fires used in which emit or discharge large quantities of smoke or flame." In the 22nd section, this language is varied only by the substitution of "proprietors *and* occupiers," for "proprietors *or* occupiers." It may appear hard to place such a responsibility upon the *occupiers* of works; but when it is recollected that the *owners* do not always reside within the jurisdiction of the Court, the sound policy of making occupiers liable is self-evident. Besides, if works were not tenanted, there would not be any nuisance from smoke. It is, therefore, the tenants who cause the nuisance.

The Court in which proceedings under the Act may be conducted, is the "Dean of Guild Court," or any other competent Court within the limits prescribed by the Act. (By the Municipal Amalgamation Act it is competent for the magistrates to try offences under any statute, the penalty for which does not exceed £10.)

The parties by whom an action may be raised are, the Procurator Fiscal. or any five householders resident in the vicinity of the works complained of. Either of these parties may act independently of each other. The Procurator Fiscal may act independently of five householders, and no five householders need wait upon the Fiscal.

The machinery provided for the purposes of the Act is somewhat cumbrous, but appears to have been well considered by its framers; and upon the whole, if worked in good faith, should effectually suppress the nuisance.

Its most important and valuable provisions consist in, first, the making the emission or discharge of large quantities of smoke or flame a nuisance. The fact of such emission or discharge being proved, the nuisance is established. And, second, that the proprietors or (and) occupiers are bound, under a penalty of forty shillings per week, to adopt the most approved plans known at the time for the prevention of the nuisance, as may be ordered by the Court, on the report of at least "three engineers, or other persons of skill in such matters." The great practical difficulty in the way of the Court, and the Procurator Fiscal, has been to get three such parties to act in the spirit of the law. Generally speaking, the parties selected, being themselves smoke

producers, have been averse to enforcing the law, and have, therefore, allowed themselves to be satisfied with the most frivolous excuses and promises on the part of thoso complained of. It is to be hoped the important duty of judicial inspection will in future be more faithfully performed.

The means by which the nuisance caused by the unavoidable emission or discharge of large quantities of smoke or flame may be reduced to as small a compass as possible, is, evidently, to diffuse the smoke or flame beforo it comes into contact with person or property. This is the means contemplated by the 21st section of the Act, by which it is provided that all *steam engine* furnaces shall not be less in height, according to the open space or inside capacity at the top, than the heights mentioned in the Act, viz. :—

Chimney stalks not exceeding in inside capacity at the top 196 square inches (14 × 14), shall not be less than 55 feet in height.

Above 196 and not exceeding in inside capacity at the top 324 square inches (18 × 18), shall not be less than 65 feet in height.

Above 324 and not exceeding in inside capacity at the top 576 square inches (24 × 24), shall not be less than 85 feet in height.

Above 576, shall not be less than 90 feet in height.

That the *cones of all glass works* shall not be less than 100 feet in height; and that the chimneys of all calcining works shall not be under 50 feet in height. But, while these are the least heights of the three descriptions of works just named, it is further provided, that the chimneys of all other works, the fires used in which emit or discharge large quantities of smoke or flame, shall be constructed of such heights, dimensions, and form, as shall be ascertained to be necessary and proper, for the prevention, as much as may be, of nuisance to the neighbourhood. You are aware that I have reported to you the names of the owners or occupiers of 115 places in which the stalks are under the heights prescribed by the Act; and that, in compliance with your directions, notices have been sent to those parties. The result of the sending of these notices confirms me in the opinion, that it will be necessary to adopt legal means with the great majority of these parties. The circulars have had little effect. In fact, the parties have been " circulared " into the notion that nothing more formidable will ever be sent to them. A few summonses would have a good effect. It would be something like the difference between blank and ball cartridge.

It is provided by the 22nd section, that " the proprietors or occupiers shall construct, or cause to be constructed, the fire-places or furnaces and chimneys of such steam engines and other works, of such form and relative dimensions, *and particularly of such proportion between the dimensions of the furnace and boiler, and of the boiler and cylinder of the engine*," in such manner as will most effectually prevent nuisance to the neighbourhood; and they are further required to cause the workmen to supply the furnaces with fuel " in such manner as may most completely secure the burning and consumption of the said smoke." From this it will be seen, that not only must the furnaces be *properly constructed*, but they must also be *properly worked.*

Mr. Muir gives a rather amusing account of the treatment he experienced in his inspection at the hands of gentlemen, who, although " they would feel disgraced by appearing on the Royal Exchange in other attire than linen of the purest white, feel no sense of shame from being the owners of chimney stalks that send forth vast volumes of black smoke that destroys many a washing." " Generally speaking I have been received by the parties more favourably than *a commercial traveller in quest of orders* would have been (!). In a great many cases I was welcomed as a friend. In a very few, not over three or four, did the parties show decided incivility; and in one case only was language used unfit for publication."

Everybody thinks somebody else's smoke more deserving of punishment than their own. Thus a large factory owner, on being remonstrated with, remarked that a small washing and bathing establishment near to his house was a greater nuisance than his own. The bath keeper said " What would be the use of my laying out money to prevent smoke, so long as these steam boats throw out so much upon my works."

The effect of any attempt at persuasion may be judged from the fact, that not one in ten of the factory owners would take the trouble to go and look at any of those places where smoke-consuming plans were in operation. As Mr. Muir says, they want a few " ball cartridges," in the shape of fines, to arouse them from their apathy.

The report recommends that the patent right of one of the plans for smoke prevention be purchased, and the gratuitous use of it allowed, in order to remove all ground of excuse on the part of factory owners. We cannot coincide with this recommendation, because it would interfere with the progress of invention, and would tax the community at large, to cover the sins of a few. We may be sure that if any plan can be used *gratis*, no other, however meritorious, will stand any chance, and the office of selection would be a most invidious one. Moreover, as we have so strongly urged, it is absurd to ask, " Which is the *best* smoke-consuming furnace ? " when it is a question of circumstances, and the peculiarities of trade operations. Messrs. Surmon and Co. agreed to sell their patent right in Juckes' furnace for £1,000, half of which was to be raised by subscription, and the other half to be paid by the corporation. The attempt to raise money by subscription has failed so far, " though, amongst those who declined to subscribe, there are parties who should have been most ready, both on account of their social position, their wealth, and the immense quantity of smoke discharged from their works."

Mr. Muir gives what we believe to be an impartial report on the merits of the different plans in use in Glasgow. His experience, however, is limited, both as regards duration and locality. Juckes's furnace, from its automaton regularity and neatness, stands first on the list. B. F. M'Callum, Esq., of Govan Croft dye works, Glasgow, states that he has had it at work for ten months. " It has not cost a farthing since put up, nor does it show symptoms of decay." Mr. D. N. Chambers, of Edinburgh, says its original cost was £95; the yearly expense of maintenance is 24*s*., which is for repairs to the door. Width of bars, 22½ inches, and six feet long from door to bridge; boiler, 25 feet long, and 3½ feet diameter; consumption 5½ tons of dross (small) weekly. The machine has been two years in use, and the bars are in as good condition as the day they were first put in operation, and not the least sign of being in any way the worse for wear.

The prices of Juckes' furnaces are as follows; but by constructing them in Glasgow, there is no doubt the first cost could be reduced:—

LONDON PRICES OF JUCKES' PATENT FURNACE.

Superficial Feet of Fire Bar in each Furnace.	Royalty upon each Furnace.	Price of each Furnace in London.
6 Feet 0 Inches.	£6 0	£56 10
7 „ 0 „	7 0	65 10
8 „ 0 „	8 0	69 10
10 „ 0 „	10 0	76 10
12 „ 6 „	12 10	89 5
15 „ 0 „	15 0	100 10
17 „ 6 „	17 10	112 0
20 „ 0 „	20 0	126 10
24 „ 0 „	24 0	137 15
27 „ 0 „	27 0	151 15
30 „ 0 „	30 0	164 0

Messrs. Gott and Son, of Leeds, send a report by their engineer, Mr. Harrison, on the use of an arrangement of fire-brick bridges, which, aided by an apparatus for admitting air, consumes " fully nine-tenths of the smoke," and saves 14 per cent. of fuel. At the back of the ordinary bridge, an inverted bridge is placed at the distance of a few inches, so that the smoke is compelled to descend to the bottom of the inverted bridge, before it can pursue its course along the boiler bottom. The drawing is not very clear, but the air appears to be admitted through the first bridge, under the fire bars, into the space between the two bridges. It is evident that this plan owes its smoke consuming powers to the extent of surface of heated fire brick over which the smoke is compelled to pass.

Bedington's plan is so similar to this, that it is needless to describe it. The arrangement of the bridges is not so judicious as Mr. Harrison's plan. The admission of the air is specified in Bedington's patent, but it is stated that, "having once regulated the size of the opening, so that the furnace works well, I have not found it necessary afterwards to alter the opening for supplying of air." Extended experience, however, has rendered the patentee wiser, for he does now use an apparatus which gradually closes the air valve by means of clockwork, after the coal has been thrown on. Mr. Harrison had already done this by means of a water cylinder or cataract, and still earlier than either of these gentlemen, we believe that Matthew Murray, of Leeds, had attached an air ane to retard the closing of the valve for the same purpose.

Mr. McGavin's plan is identical with Messrs. Galloway's original double furnaced boiler. Messrs. Mitchell and Wallace have a similar plan, in which the two furnaces unite in a single circular flue, whilst more furnace and ash-pit room is obtained by making the adjacent sides of the two furnaces flat, with stays between. The extreme sides are also made to the same curve as the boiler, and stayed. These furnaces want more stays to render them safe under high pressure steam. Drawings of Messrs. Galloway's boilers are also given with the report.

If the Glasgow authorities take our advice, they will purchase no patent. Mill owners, like other folk, set no value upon that which costs them nothing, and if through the ignorance and perverseness of those in their employ, any difficulty arises in the application of the particular plan placed gratuitously at their service, they will inevitably throw all the blame on the authorities. To the contumacious smoke producers, our advice is, briefly, *Respice fine 'em!*

(To be continued).

NOTES BY A PRACTICAL CHEMIST.

Test for minute traces of Iodine, and Method of separating Iodine from Bromine and Bromides.—According to M. Grange, the presence of iodine can be easily found in any colourless liquid containing five-millionths of its weight of iodide of potassium. A few grammes of the liquid are poured into a test-glass, a few drops of starch mucilage added, and a few bubbles of fuming hyponitric acid passed through it. The liquid, if containing iodine in the above-mentioned proportions, at once acquires a pale rose colour, bordering on violet. If the liquid contain one hundred-thousandth of iodide, it becomes a bright blue. Alkaline salts, if present, do not interfere. Salts of lime, especially the chloride and sulphate, slightly alter the re-action; the liquid becoming paler and more violet. If the re-action is not distinct, the liquid should be let stand a few minutes, when iodide of starch is deposited.

If the liquid contains only one-millionth or under, hyponitric acid is passed through it, and the whole is then well shaken with a small quantity of chloroform, which dissolves the liberated iodine, and acquires its characteristic rose colour. Hyponitric acid not being capable of decomposing bromides, the smallest trace of iodine may thus be separated from waters or solutions containing bromides. In a similar manner, the iodide of potassium may be used as a test for nitrites, by means of a solution of starch, and a little very dilute hydrochloric acid. In examining organic substances, or liquids coloured with organic matter, they must first be reduced to ashes in contact with caustic potassa, and the residue lixiviated with a little water.

Sulphate of Zinc as an Antiseptic.—According to Falconet, animal matter, such as brain, intestines, and other parts difficult of preservation, may be kept without any alteration in a solution of the sulphate of zinc, and without the contraction caused by alcohol.

Animal Phosphorescence.—Mr. T. J. Herapath, in a paper read before the Chemical Society, combats the view that animal phosphorescence is owing to the slow combustion of phosphorus. Having made experiments with glow-worms, which were kept in glass vessels whilst emitting light, he found that no ozone was produced. Hence it was concluded that the phosphorescence of the glow-worm is not caused by phosphorus. The author ascribes the phenomena in question to carbon in some allotropic condition, not as yet understood. This subject is the more interesting as bearing on the question at issue between Liebig and Mulder, as to whether phosphorus occurs in the animal frame merely as phosphoric acid, or in other non-oxygenated compounds, such as phosphamide. If it can be shown that the luminous phenomena occasionally witnessed in the sweat and urine of living animals, and in the putrescent flesh of such as are dead, are not due to phosphorus, the existence of non-oxygenated phosphorus compounds in the body will be rendered highly doubtful.

Spontaneous Decomposition of Gun Cotton.—Dr. Gladstone has found that the different explosive bodies prepared by the action of nitric acid upon woody fibre, starch, sugar, &c., suffer, in course of time, either entire or partial decomposition.

Test for Gums.—*Arabine*, the leading constituent of gum-arabic and senegal, is soluble in cold water, whilst *cerasine*, which preponderates in cherry-gum and gum tragacanth, is insoluble therein. The former is precipitated from its solutions as a yellowish, gelatinous, transparent mass, by persulphate of iron. Thus we may distinguish arabine from dextrine, and other gum-like vegetable bodies, upon which sulphate of iron has no effect. The presence of sugar does not at all interfere with the test. The soluble portion of gum tragacanth is, indeed, precipitated by sulphate of iron, but it gives, with tribasic acetate of lead, a transparent gelatinous precipitate, whilst that produced by arabine with the same re-agent is white, flocculent, opaque, and curdy.

Formulæ for Marking Ink.—No. 1—

Nitrate of silver	11 parts.
Distilled water	85 „
Powdered gum arabic ..	20 „
Subcarbonate of soda ..	22 „
Liquid ammonia	20 „

Dissolve the soda in the water, put the gum in a mortar, and add by degrees the solution of soda, rubbing well with the pestle. Then dissolve the silver in the ammonia, and mix the solutions. Heat the whole in a flask till it reaches the boiling point, when it turns a deep colour, and sufficiently liquid to flow from the pen.

No. 2.—Nitrate of silver ..	5 parts.
Water..	12 „
Gum	5 „
Subcarbonate of soda	7 „
Ammonia	10 „

Mix as above, and evaporate in a flask until the whole has acquired a deep brown tint. This ink forms black characters, and is well adapted for stamping.

No. 3.—Nitrate of silver ..	17 parts.
Water	85 „
Gum..	20 „
Subcarbonate of soda	22 „
Ammonia	42 „
Sulphate of copper ..	33 „

Dissolve the soda in 25 parts of water, and the silver in the ammonia. Put the gum in a mortar with the remainder of the water, constantly stirring; pour in the solution of soda, and finally put the whole into the solution of silver. Lastly, add the copper. This ink has a blue tint. In using it, a hot iron should be passed over the characters formed.

Ancient Mural Paintings.—According to the researches of MM. Dumas and Persoz, the red and violet colours employed in these paintings were prepared from certain common sea-shells, such as *Tellina fragilis* and *Neretina fluviatilis.*

ANSWERS TO CORRESPONDENTS.

"Q. A., Walsall." The sample you forwarded is perfectly pure. The difficulty you find in disposing of it arises simply from the unfortunate circumstance that many parties, unable to analyze a sample themselves, and unwilling to employ a professional man, prefer to be guided by certain fallacious outward signs. Thus an inferior article obtains the preference, and the honest and talented manufacturer is too often driven out of the market.

"Chemicaster." *Soaps* are formed by the combination of the fatty acids with alkalies (potash, soda, magnesia.) *Plasters* are formed by the same acids with heavy metallic oxides, such as those of lead, zinc, &c.

S.

MESSRS. EASUM AND BROWN'S PATENT ROPE.

Messrs. Easum and Brown, of Commercial-road, Stepney, have recently patented an improvement in the manufacture of rope, which, if it answers the expectations formed of it, will present a singular instance of the upsetting of an old and apparently very simple system of manufacture. The strength acquired by a filament of hemp, after being twisted, is apparent to the most casual observer; but Messrs. Easum and Brown contend that we have been in the habit of twisting too rigidly. On their system, the hemp is made into slivers, and instead of twisting them into yarns and then uniting them to form a strand, the slivers are at once made into a strand, without being first made into yarns. By this means, the fibre lies more nearly in a line with the length of the rope, which is found to be stronger than rope made in the ordinary manner. The ropes may also be made very *flexible* in this manner, so as to be admirably adapted for cranes, blocks, &c. As regards durability, of course it is rather early to speak as yet; but Messrs. Easum and Brown have had one driving their rope machinery for several months, and it appears likely to wear out two ordinary ropes at that work, which is a very severe test. The 1½ inch Manilla rope, or point line, carried 25 cwt., and broke by a slight increase of weight. The Government test is 14½ cwt., and they pass any rope that will stand that weight. See the following table :—

	Government Test.				Easum and Brown's rope bore			
	T.	C.	qrs.	lbs.	T.	C.	qrs.	lbs.
4 in. rope ...	4	0	0	0	7	15	0	0
3 ,, ,, ...	2	5	0	0	4	1	0	0
2 ,, ,, ...	1	0	1	0	1	15	0	0
1½ ,, ,, ...	0	14	2	0	1	5	0	0

The ordinary rope is probably somewhat stronger than the Government test to insure its being passed; and Messrs. Easum and Brown state their rope to be from 30 to 60 per cent. stronger than rope made of the same materials in the ordinary manner.

Parcels of it are now out on trial in several ships, and for other purposes.

The following extract from the specification (drawn by C. Cowper, Esq., C.E., of Southampton-buildings, Chancery-lane), will give a correct idea of the process of rope-making generally.

Now know ye, that in compliance with the said proviso, I, the said Robert Hayes Easum, do hereby declare that the nature of my invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following statement thereof; reference being had to the drawings hereunto annexed, and to the figures and letters marked therein, that is to say :—

And in order more fully to explain the nature of my invention, and in what respects the same differs from the ordinary modes of making rope, I will first proceed to describe some of the ordinary modes now employed for that purpose.

In one of these modes, the workman takes up a quantity of hemp, and places it round his body. He pulls out a portion, and attaches it to a hook at the end of a spindle, which is caused to revolve by strap, or wheelwork, or otherwise. The workman then walks backwards, away from the spindle, and at the same time he feeds out the hemp with his hands, in as regular a manner as possible, from the mass which he carries with him. He thus proceeds down the rope-walk, until he has obtained a "yarn" of sufficient length. A number of "yarns" thus made, are laid together, and twisted into a "strand," or "ready." For this purpose, the "yarns," are passed through separate holes in a perforated plate, and unite and then pass through a tube, or a cylindrical hole in a block of metal, and are then attached to a hook on a revolving spindle, mounted on a carriage, which is made to travel down the rope-walk by means of machinery. By this means the yarns, which have been each separately twisted, as above mentioned, are twisted together to form the "strand," or "ready." Three or more of these "strands," or "readies," are then twisted together to form a "rope," and three or more "ropes" may be twisted together to form a "cable." The different stages may therefore be expressed as the *hemp*, the *yarn*, the *strand* or *ready*, the *rope*, and the *cable*. It will be observed that the hemp, in this process, is formed into a "yarn" directly.

By another process or mode of manufacture, also in use heretofore, another stage is introduced before the conversion of the hemp into yarn, by means of which the process of hand-spinning above-mentioned is avoided, and the operations of converting the hemp into yarn are performed by machinery. In this process, the hemp is laid by hand upon a table, from which it is conveyed by a pair of rollers into a machine consisting of an endless web or chain of spikes, over which the hemp passes, and is conveyed by another pair of rollers into a cylindrical can. These last rollers move at a greater velocity than the endless chain of spikes, and the hemp is thus drawn out into the form of a long narrow band or "sliver," which is loosely coiled up in the can. Several slivers thus made, are passed together through a second similar machine, and this operation is repeated until the irregularities of the sliver are sufficiently equalized. By this means is obtained a long narrow sliver or band, consisting of parallel fibres of hemp, lying side by side, without twist. To convert the "sliver" into "yarn," a cylindrical can, full of sliver, is placed in a vertical position in a machine where it is caused to revolve with immense rapidity on its axis, while at the same time the sliver is drawn gradually out of the can, through a tube revolving at the same speed as the can. By this means the "sliver" is twisted into a "yarn," which is wound up upon a reel. The "yarns" thus made, are twisted into "strands," or "readies," and the strands into ropes, and the ropes into cables, in the manner above-mentioned. In both these processes, it will be observed that the rope or cable consists of an assemblage of small twisted yarns, each of which has been separately twisted; and such yarns frequently have twelve twists or turns in a length of one foot.

Now, in making rope according to my invention, I first convert the hemp into "slivers," as above mentioned, and I then twist a number of these slivers together to form a "strand" or "ready," without first twisting each sliver separately as in the old method above mentioned. The strands or readies thus made are laid together to form ropes, and the ropes may be laid together to form cables if desired. The fibres of the hemp are thus laid more nearly in the direction of the length of the rope, than is the case in ropes made in the ordinary manner, and I have found that ropes thus made according to my invention, possess greater strength than ropes of equal weight made in the ordinary modes. They also admit of being made very flexible.

In lieu of using the slivers entirely without twist, they may be slightly twisted, but in no case is such amount of twist to exceed four turns in a length of one foot. At the same time I would remark that I prefer to employ the slivers entirely without twist as above described.

PROGRESS OF AMERICAN INVENTION.

Report of the Commissioner of Patents, United States. Part 1, Arts and Manufactures. Part 2, Agriculture. 1850–1. Washington, U.S.

After the bungling attempt at legislation on the patent laws perpetrated last session, and with the prospect of the ensuing session being

devoted to party warfare, to the exclusion of any useful reform, we are afraid to venture any hope on the possibility of an English Commissioner of Patents ever having it in his power to return the compliment which Mr. Ewbank has paid us, by forwarding us copies of his reports made to the House of Representatives. They contain a vast amount of valuable information; and the public money would be well applied, if a small portion of the sums spent in building ships and pulling them to pieces were expended in reprinting these volumes, and presenting a copy to every Mechanics' Institute in the kingdom. With the patents we have already attempted to deal, by selecting the most intelligible of the "claims" as they appear periodically in the *Franklin Journal.* And here we may take occasion to remark on the loss which the scientific of Europe sustain from the incompleteness of the method adopted in reporting the patent specifications; *merely the claims are given*, and the small number we are able to extract with any hope of their being understood, shows the evil which arises from such a Procrustean system. As it is, we feel sure that most of our readers get a very inadequate notion of even those which we do select; and although we, as Englishmen, have least right to complain, we trust that our friendly remonstrance may be seconded by some of our readers, of whom we have not a few, in the States. If they are to be published at all, no useful end is to be attained by doing it imperfectly. Indeed we see no reason why illustrations should not be given of a portion, at least, of the inventions, and such a task could be performed more satisfactorily by the official examiners than by the irregular efforts of an irresponsible journalist.

In addition to the patents and designs of which analytical indexes are given, there are the statistics, from which we learn that the number of patents lying unexamined in January, 1850, were nine, which added to the total applications during the year, amounted to 2,202. Of this number, 995 were granted, 169 remained unexamined, and 1,038 remained suspended, or entirely rejected. The amount of money received during 1850 was \$86,927.05, and the expenses \$80,100.95, leaving a balance in favour of the office of \$6,826.10.

It is curious to remark the subjects upon which American inventive genius delights to dwell; of the 883 patents here specified, 48 are for stoves and cooking ranges; 29 for mortising machines and saw mills (seeming thereby to justify Sam Slick's reflection on those who "strain at a gate and swallow a saw mill"). Steam engines and boilers are the next favourites, standing 30 on the list. The machinery connected with textile fabrics is scarcely susceptible of analysation, it numbers about 51. There are 21 for seed planters, 15 for churns, and 12 for ploughs. The rest include every variety and shade of invention, from "alloys for the points of lightning rods" to "submarine telescopes," and a "kettle for manufacturing comfits." We must take the opportunity of analysing those which have escaped our notice.

One is for applying vulcanised India rubber, or other similar elastic material, interposed in the joints of connecting rods, and similar appliances for converting rectilineal into circular motion, in order to diminish concussion. Another is curious, but its utility seems very doubtful. We give it in the inventor's words,—"What I claim as my invention is, the running the exhaust pipe into the main steam pipe, curving it, and providing it with an aperture and valve, by which the current of steam from the boiler has a tendency to open the valve at intervals, and draw into the steam pipe a portion of the exhaust steam." In one of our early numbers will be found an instance of the power of a current of steam, shown in the collapsing of an exhaust pipe of a steam engine, the air being so completely expelled by the jet of steam, that the effect of the external pressure of the air was unresisted. We hope that we are not hinting at an object too undignified, but we can conscientiously recommend "Mr. Eliphalet S. Scripture" to exhibit his invention at the next "World's Fair" (at Greenwich), where it could not fail to prove a good speculation. We must quote *verbatim* his claim for an "improvement in flying horses," for fear we should do the inventor any injustice,—"What I claim is, the combination and arrangement of the undulating cams with the levers, and these with the flexible connections to the front part of the horses, for the purpose of, and by which I produce the rising and falling motion, which I term the galloping motion, as hereinbefore described and represented."

Another scheme of a more utilitarian character is, that of Mr. Duff Green, who proposes to form embankments, or "levees," as they are termed, by constructing "filtering dams," and turning into these dams a stream of water from a higher level, which, in its course, will bring with it the soil which it detaches from its bed, or which may be designedly thrown into it, and which will be deposited in a concrete mass inside the dam, whilst the water filters off through the interstices.

Another inventor proposes to employ large washers, under the heads of carpet tacks, for the purpose, we presume, of fastening down the carpet more uniformly, and preventing the head cutting through. A simpler plan would appear to be, to make a large head to the tack at once, but this might not suit the tack-making machine so well.

It is interesting to note the eagerness with which any plan for dispensing with manual labour is taken up. Thus, in this country where labour is a drug, we set paupers to mend the roads, in sheer despair of finding them anything better to do. On the other side of the Atlantic (the "ferry toll" is only five pounds), Mr. N. Potters invents a "machine for repairing roads," and says "what I claim is, hanging the cutters for cutting off the ridges at the sides of the ruts, the scrapers for scraping the dirt into the ruts, and the roller for pressing and smoothing the road, upon the same frame."

We observe some "notions," hitherto uncultivated by any of our inventors, having for their object the safety and removal of articles from shops, in case of fire. The counters are made thief-proof, and are also arranged so that they can be wheeled out of suitable openings, in case of the shop taking fire. Mr. Porter, in his "Statistics of Self-imposed Taxation," forgot to tell us how much we annually pay the Insurance Offices for the privilege of playing at the game of squirting water over our houses, when they take fire. We hope that the next generation will see this expensive farce abolished.

A "composition for covering hams" is thus described by Horace Billings: "What I claim is, the formation of a preserving composition for coating meats, fruits, vegetables, &c., by the union of resin, shellac, and linseed-oil.

The following is graphic,—"What we claim as our invention is, the method of hanging a mill saw from guides in advance of its front edge, which sustains the whole pressure caused by the advancement of the wood on the carriage against the saw teeth, the plate of the saw swinging on the advanced guides, as pivots, so that when cutting it is kept running in a plane, passing through the guides, in the direction in which the carriage moves, as a vane is kept by the wind in the direction in which it blows."

We are indebted to America for various plans for coupling pipes, none of which, as far as we are aware, have found much favour in this country. The principle on which some of them act, is expressed in the following claim,—"I claim the fastening together the abutting ends of two pipes, by forcing a sleeve (socket) of some hard substance over a belt of a softer substance, which envelopes the seam, and is thus compressed between the sleeve and the pipes."

The use of wood as fuel in locomotives is attended with some inconveniences, from the torrent of ignited particles which issue from the

chimney when the fire is stirred, and which find their way in at the open windows of the carriages. This is proposed to be obviated by Messrs. Bradford and Morris, by carrying an air-pipe, projecting beyond the chimney, over or under the carriages, through which a supply of air is forced by the motion of the train and supplied to the carriages. If an *outward* current of air can thus be effected at the windows, it is probable that the entrance of sparks, smoke, and dust can be prevented.

A *cheap* method of forging hollow wrought-iron shafts is a desideratum in mechanics. It would give us increased rigidity, with diminished weight. Mr. Charles Fisher proposes to do this by connecting together (*how*, the claim does not inform us unfortunately) *short* cylinders of plate iron, the reduction of the length, of course, facilitating the welding of them.

We are not very clear about an alleged improvement in the manufacture of gun barrels out of two bars, rolled into a semi-cylindrical form, thus necessitating two welds the whole length of the barrel.

Lead pipe is now made by pressure (treating it as if it were clay), and we find claimed, "A method of setting or cooling the inside of the mass of metal within and throughout the length of the cylinder, and before, or preparatory to pressing out the pipe, by passing a cooling fluid into or through a long core or coreholder, extending through the length of the cylinder, the said method having the effect at the same time, to keep the said core or coreholder cool and stiff."

We find a claim for the use of lime in the preparation of gutta percha, in order to neutralize the acids which it contains in its natural state. It is also stated to preserve it "wholly or in part" (a useful form of saving clause, worth noting) from deterioration from the atmosphere or heat. A still more extraordinary idea seems to be "the application of an acidulous composition to wheat," the composition being chiefly vinegar, or vinegar and sulphuric acid, for what purpose "deponent sayeth not."

Among the improvements in tools, are a method of fixing handles in augers, "by means of a tube attached to the inner half of one part, and an eccentric attached to the inner half of the other part of the handle, the eccentric part passing into the tube, and the eccentric fitting into the dovetailed grooved slot of the shank." Another plan is, making the handle in halves, one piece screwing into the other, and the eye of the auger being clipped between the two shoulders. Also, a method of constructing spring callipers, by placing a circular spring in the joint, as common snuffers springs are made. An improved hay fork is described, each tine of which is fixed in a socket so that one or either can be replaced, as they become worn or injured. In another fork, the position of the tines can be varied, so as to make it a two, or three-tined fork, at pleasure.

M. Soyer may take a hint from Mr. T. G. Stagg, who proposes to "masticate" his steaks before cooking, by passing them between toothed rollers, to render them more tender, we presume.

The effect of corrugating metal is well known; we believe that the credit of suggesting the use of corrugated iron for boiler furnaces is due to Mr. R. Montgomery.

A new process for hardening fats and oils, without separating the stearine from the oleine, is described by Mr. C. W. Schindler; it consists in the addition of cera japonica and gum elemi, which raises the point of fusion to 135 degrees Fahrenheit. Mr. Warner claims a new method of fastening hooks and eyes on paper, the points of the hooks being upon one side of the paper, whilst the eyes are upon the other, whereby the latter are prevented from falling off.

A method of elevating and cooling flour at the same operation, by means of a blast, is described. This resembles Adcock's spray pump, in which the water was to be "rained upwards."

The following are extracts from the "Summings-up" of the Examiners in the various branches of the Arts:—

Under class 8, there have been some very interesting improvements, especially in the matter of telegraphs. Letters patent have been granted for a thermal telegraph, the principal feature of which is the use of a platinum wire, heated by the current, for burning marks upon a fillet of paper. The platinum wire is bent to an acute angle, which touches with its apex slightly upon the travelling fillet of paper. Each time the current passes in the wire, the heat generated makes a mark upon the paper. A new species of electro-chemical telegraph has been patented, in which marks are made upon a metallic plate, instead of paper. A small glass tube, holding some acidulated solution, rests upon a large metallic disk, and as the disk revolves, the point of the tube, which is slightly perforated, traverses a spiral line in which the marks or impressions conveying the intelligence are to be made. A platinum wire is inserted in a glass tube, and whenever the galvanic circuit is completed through the platinum wire, acid, and plate, a black mark is made upon the plate, which is of brass. These marks are strong and well-defined, and after the communication is read off, they are easily effaced from the brass disk. The perforation in the point of the tube is sufficiently small to prevent the acidulated water from running out, though sufficient escapes for electrolytic action.

Electro-magnetic Enunciator.—An invention with this title has been patented, as a substitute for the usual bell-ringing apparatus in hotels and other places. It is, in fact, a species of electro-magnetic indicating telegraph, and ingenious in its construction and mode of operation.

Electro-magnetic Repeater.—This invention, but recently patented, is one of considerable novelty and beauty, and is designed for the purpose of repeating or recording a communication in several places at once, along a line of electro-magnetic telegraph, and at the same time allowing the galvanic circuit to remain open when the line is not in use, which is an important condition to be preserved. Another instrument, for a similar purpose, was patented about the same time; the operation of which requires the circuit to be kept closed.

Telegraph Manipulator.—A very ingenious, though complicated machine, for communicating signals in telegraphs where they are recorded in dots and lines. Ordinarily these are made by striking a lever or key with the finger, but by this instrument, any combination of dots and lines representing a letter, is at once made and recorded, by simply depressing a key having the desired letter marked upon it. It requires but one motion of the finger, instead of the great number required for some of the letters in the ordinary way. If the machinery is made accurate, it will prevent many mistakes from being made by telegraphic operators.

Electro-magnetic Engines.—Two engines of this class have been patented; one of them having for its principal feature the employment of the secondary current produced by one magnet to charge an auxiliary magnet. The feature patented in the other engine is a novelty in the *cut-off.* The cut-off is the contrivance by which the galvanic current is conveyed to, and intercepted from the electro-magnets, and is usually made to operate by the pressure of conducting metallic springs upon metallic disks; either the springs or disks being made to revolve, according to circumstances. In the present case, revolving metallic points are brought successively into contact with the surface of a metallic roller, which is pressed against the points by means of a spring.

Fine Arts.—*Daguerreotype Plate-holder.*—It has long been an object to obtain some means for holding daguerreotype plates in such a manner while cleaning and polishing them, that the plates should not be handled, and that they should present smooth edges to the buff stick or polishing wheel, and at the same time that the plates, when cleaned and polished, could be readily removed from the plate-holder. Various kinds of clamps have been tried, and the plates have been cemented to blocks, &c., but no plan seems to have combined the advantages possessed by the one before us. The edges of the plate are turned down to a right angle or more, by means of a burnisher or other tool specially designed, and the block upon which the plate is secured, is an expansible block, the edges of which press against the turned edges of the plate, and thus hold it in place. The expansion of the block is to be produced by springs, wedges, screws, cams, or other means.

Electrotyping.—An ingenious device in this art has been patented for pre-

venting the electrotype cast from adhering to the original plate. Many ways have been tried to obviate this difficulty, but the present is a decided improvement upon them. It consists in acting chemically upon the surface of the copper plate, to so slight an extent as not to injure the impression, nor interfere with the electric deposit. The inventor prefers, in his operations, to iodize slightly the surface of the plate, and then to submit it for some time to the direct rays of the sun.

Mills.—About twenty-four patents have been granted during the past year for improvements belonging to this class, thirteen of which are for improvements in mills for grinding and crushing. So much has heretofore been done in this class, coming home as it does to the wants of man, even in a barbarous state, and having exercised the genius of the inventor from the earliest ages to the present time, that little of a radical character can be expected; and accordingly, the improvements patented during the past year consist of slight modifications of what was previously known. One of these patents is for a mode of steaming grain as it passes from the hopper to the stones, for the purpose of softening the outer coating of the grain to prevent its being ground so fine as to mingle with the flour in such a manner as not to be separated from it by the bolt. The idea of steaming preparatory to grinding is not new, but the patent was granted for the inventor's convenient mode of applying the steam. Another of these mills consists of two or more hollow cylinders or rollers, the smaller being placed within the larger, and being free to revolve, so that when the outer cylinder revolves, the inner one will also revolve by its weight, and crush whatever substance may be placed in the outer cylinder. Up to this point the mill is old, but in addition, it comprehends an arrangement by which the inner cylinder, in addition to its weight in rolling, is caused to give a series of blows to the mass, for the purpose of breaking the more refractory parts, and freeing others from their adhesion to the sides of the mill. Another pulverizes sugar or other materials, in a series of mortars in which the beaters work in succession, while the range of mortars revolves in such a manner as to bring them to the feeding-point, and to the discharge aperture, as the material in each becomes sufficiently pulverized. In another of the mills, a very firm elastic substance is placed in the spindle, under the cock-head, to prevent abrasion, and to relieve concussions. In another of the mills, the crushing is effected by a series of rollers, between which the grain passes without being rubbed, and the crushed particles then fall upon a toothed roller working in a concave, when they are opened and afterwards the flour is separated from the bran. Several other patents for improvements in grinding have been granted, but it is not deemed necessary to give further details. Several patents have also been granted for improvements in bolting and dusting bran, which will not be described, but will be understood by a peruser of the claims.

Horse Powers.—But one patent has been granted within the past year for improvements in horse powers. The subject seems to be nearly exhausted, and until some new track is discovered, very few patents can be expected in this plethoric branch of machinery. The patent above mentioned is for an improvement by which the master wheel is held in position, or allowed to cant over, for admitting the horse.

Letters patent have been granted for an improvement in the friction clutch, adapted to various resistances. It is so arranged that, as the pulley revolves upon the shaft, the friction of the clutch will constantly increase, until it becomes sufficient to carry the shaft, at which point the pressure becomes constant; but if the shaft becomes loaded in such a manner that the friction is insufficient to carry it, the friction will immediately be increased to the requisite degree by the action of the machinery. The device appears to possess much merit.

Metallurgy.—In this large and important class, about ninety patents have been granted, which are divided among the various sub-divisions of this class, much in the same ratio that they were during the preceding year, with the exception of those which have for their object the separation of the precious metals from the impurities with which they are found mechanically mixed. These ore washers, or gold separaters, are not so numerous in proportion, as during the year 1849. The field of invention has been, to a great extent, covered by the machines of the previous year, and there is more difficulty in discovering novelties, either in the application of principles, or in the adaptation of mechanical devices for bringing such principles into more successful action. Moreover, the market is filled with the machinery already manufactured, the demand and the profit are both more limited, and there is less inducement for the inventor to rack his brains, and concentrate his abilities for the improvement of this class of machines.

But five patents have been granted for such machines, and only two of these differ in any great degree, from those previously existing. In one of these the finely pulverized ore and water is introduced into a revolving basin, the cavity of which is deepest near the edges. From the bottom of the deepest part of the basin, and attached to it, descend tubes largest in their bore at the upper ends. As the basin revolves, the lower ends of these tubes, which are all on the same level, pass in succession over the surface of mercury contained in a ring shaped trough; their length being sufficient to give the stream of ore and water passing through them such an impetus as will drive it to the bottom of this trough. The water and the impurities rise, by virtue of their greater levity, to the surface of the quicksilver, and run to waste over the sides of the trough. A portion of the gold is amalgamated and retained by the mercury, other portions of it rise to the surface, but as they rise are met, and again forced under by the stream of fluid, proceeding from the next succeeding tube. The gold is thus immersed and re-immersed continually, until it is kept so long in contact with the mercury, as to be amalgamated and retained.

The machine is said to save nearly all the precious metal, and to be working to advantage on the Virginia ores, which yield but a small per centage of gold. In the other machine referred to, a species of oscillating and *shocking* motion in two directions, in planes at right angles to each other, is communicated to the same pan. It is not known that this machine has come into use, but its peculiarities appear to be such as would render its action successful upon ores in which the gold is found in large particles.

A process *for making steel from cast-iron* has been patented, the novelty in which consists in decarbonizing cast iron, in the shape of thin plates, and piled in layers, with strata of pulverized oxide of iron. The materials thus arranged, are exposed to the action of heat for several days, in an oven, such as is employed for making blistered steel, care being taken not to raise the heat sufficiently high to melt the mixed mass. Samples are from time to time withdrawn, to ascertain the degree to which decarbonization has proceeded. When the operator judges that the proper extent has been reached, the thin plates are withdrawn and treated in a crucible, much in the same manner as blistered steel is, when converting it into cast steel. Good steel is produced by this process, and works for carrying it on are now in successful operation.

A patent has been granted for improvements in well known processes for obtaining wrought iron directly from the ore; the novelty consisting in arranging the deoxydizing chamber, which is heated by the waste heat, in such a manner that its contents shall not be exposed directly to the flame; while at the same time they can be permitted, at pleasure, to descend upon the working bottom below, without being exposed to a current of unburnt atmospheric air.

Patents have been granted for several tuyers, and for an improved arrangement of a steam boiler, in connection with a cupola furnace.

A patent has been granted for an improvement in steam hammers, the novelty consisting in attaching the hammer to the cylinder, instead of to the piston rod. The piston stands at rest, while the cylinder rises and falls; the advantages of the arrangement are obvious, and the inventor proved that his discovery was prior to an English publication of the same apparatus.

A patent has been granted for certain very ingenious improvements in the blacksmith's striker, which is worked by the foot of the smith. An intelligent description of them, without a drawing, would be difficult.

Two patents have been granted for devices for giving a rotary motion to the fluid iron from which chilled rolls are cast, and one for a plan by which large kettles can be cast with facility in metallic flasks, which are in shape nearly similar to the kettle to be produced. The process consists in applying a stream of cold water to the inner half of the flask or lantern which supports the core, at a time when the melted metal enclosed, is arrived nearly at a solid state. The inner part of the flask is thus caused to contract rapidly, and, when contracted in diameter, it can easily be withdrawn, both from the kettle and from the exterior half of the flask.

Another plan for accomplishing the same result, has been devised and

patented; it consists in making the core supporter, or inner half of the flask, a flexible iron basket, which, it is obvious, cannot be either broken, or pinched fast by the contraction of the cooling kettle.

Patents have been granted for an apparatus for applying water to the outside of the hubs of cooling car wheels; for machinery for forming cores for small pipe; and for improvements in the composition from which small cores are formed.

A very ingenious machine has been patented for forming the wrought-iron railroad chairs, which are now by degrees taking the place of the cast ones hitherto employed. In this machine, the iron, in bars of the width and thickness of the intended chair, is fed by hand between a pair of moving jaws; which, as they approach each other, cut off the proper length for a chair, punch in it the spike holes and clamp it firmly between them. While the blank is thus held, a pair of punches rise up, make the necessary slits in the chair, and, as they proceed, bend the lips at right angles to the bed. These same punches then approach each other, and bend the lips over towards a common centre, and into such a shape as shall embrace the lower fin of the rail. The upper jaw then rises and separates into two parts, and the finished chair is thrown from the machine by a discharger.

A machine for making chains, into which a wire or rod is fed by self-acting mechanism, and from which a finished chain is discharged, presents, perhaps, the most curious triumph of persevering ingenuity over apparently insurmountable difficulties, that has been brought before my notice during the present year.

This machine is not complicated, when the various duties that it has to perform are taken into consideration; but its construction is such, and its parts are so numerous, that a clear description of it without drawings is almost impossible; suffice it to say, that the wire is first presented to nippers or shears, which cut off a length sufficient for a single link. One half of this length is then bent into an annular figure, leaving the other half still unbent and projecting from the ring.

Other mechanism then approaches, seizes the unbent portion, and forms it into another ring, a plane passing through which is perpendicular to a similar plane passing through the first named ring. A link, technically termed a jack-chained link, is thus completed. The last named mechanism then retires, leaving the link still held fast by the first set of bending machinery, which in its turn moves backwards, carrying and holding the finished link in such position, that the succeeding length of wire is fed through the last formed ring of the link. These operations are repeated in succession, and the finished chain drops in a stream from the bed plate of the machine.

Such chains are employed for chain pumps for household purposes, and are furnished so cheaply, that pumps constructed with them, and of sufficient size for ordinary wells, are furnished complete for about 15 or 20 cents a foot.

(To be continued.)

ABSTRACTS OF RECENT AMERICAN PATENTS.

For an *improved connexion of telescopic masts and spars.* Charles F. Brown Warren, Rhode Island, June 17.

The nature of my invention consists in connecting the tubes together and adjusting them by means of a screwed rod or rods, running longitudinally through them; each rod being secured in one tube, so as to be incapable of turning, and passing through a nut or nuts in one or more of the other tubes; the whole series of tubes being adjustable, one within another, by turning those in which are the nuts, so as to move the nuts along the screw on the rod, and each tube being capable of being secured by set screws, at various points of its length.

Claim.—What I claim as my invention is, connecting and adjusting the several joints of masts, yards, and all spars constructed of telescopic tubes, or tubes fitting one within another, by means of a screwed rod or screwed rods, nuts, and female screws, and set screws, or their equivalents; the whole being inserted in and secured or attached to the tubes, and operating in the manner substantially as herein set forth.

For an *improvement in printing names of subscribers upon newspapers, &c.,* Henry Moeser, Pittsburgh, Pennsylvania, June 24.

Claim.—What I claim as my invention is, the arrangement and construction of a machine for printing names of persons or places, on newspapers and other papers, after the manner substantially as described, viz.: of a form containing the column of names to be printed, set up in types, and being brought under the action of a stamp, by means of a slide moving by degrees; together with the application of a slitted plate, allowing the paper (to be printed) to be pressed down on the line right beneath the slit of the plate, and shielding the paper from the lines adjoining that under action of the stamp, as hereinbefore described.

For an *improvement in cars for transportation of coal.* Laurence Myers, Philadelphia, Pennsylvania, June 24.

The nature of my invention consists in one, two, or more metallic cylinders, which are adjusted in a frame, so as to be guided by it, and which cylinders have flanched rims firmly secured to them, at such points upon the cylinders as will adapt them to the width of the railroad track upon which they are to run, and upon which flanched rims the cylinder and the material contained therein revolve,—the material being kept in place whilst the car is in motion, by the centrifugal force, and prevented from falling, or rolling, whilst in the act of stopping or starting, by a partition or partitions in said cylinder.

Claim.—Having thus fully described my invention, I wish it to be distinctly understood, that I do not claim the use of cylinders for conveying material upon common roads, as this has been done heretofore; but what I do claim as of my invention is, the combination of a partition or partitions, with a metallic cylinder or cylinders, provided with flanched rims, as herein described, for the purpose of carrying material in bulk, on rail or other roads, where high velocities are attained, said material being held in place by centrifugal force whilst in motion, and prevented from falling or rolling in the cylinder by the partition or partitions, whilst in the act of stopping or starting, as herein fully described and shown, or by any other means essentially the same.

For an *improvement for making gutta percha hollow ware.* Samuel T. Armstrong, city of New York, June 24.

My improved process is applicable to the making of all kinds of hollow articles which can be formed in moulds, such as bottles, or articles which may be made hollow of gutta percha, or gutta percha compounded with other substances.

Claim—What I claim as my invention, in the process above described, is the method, substantially as described, of moulding articles of gutta percha, or the compound of gutta percha with other substances, by first making the same in the form of a pipe, and whilst in a partially heated and plastic state, giving to it the form required in a mould by forcing a liquid inside, to expand the gutta percha as described.

[The same idea was suggested by us to the Gutta Percha Company, for lining large cast-iron pipes with a thin layer of gutta percha. It was proposed to make a pipe of gutta percha, slightly smaller than the iron one, and having slipped it inside it, and closed up the ends (as in proving pipes), to pump in water at a proper temperature, under a pressure sufficient to create an intimate union between the gutta percha and the iron. Cold water would then be allowed to flow in, to set the lining, before the pressure was taken off.—Ed. *Artizan.*]

NOTES ON RECENT ENGLISH PATENTS.

F. J. S. Hepburn, for *Improvements in the manufactory of Carriages and other Vehicles*, dated June 17th, 1851.

These improvements consist in applying a new method of ventilation to carriages. A false roof is constructed, a few inches below the ordinary external roof, composed of perforated metal, or any suitable fabric. Air-openings, provided with valves, are fixed in the sides of the carriages, in the space between the two roofs, through which the air passes; its distribution being effected by the false roof, so that no draught is felt. The valves are opened and closed at pleasure, by means of cords inside the carriage. We have seen a plan applied (although we are not aware whether it is patented or not), in which an inside lamp was employed to warm and ventilate the carriage, the former a desideratum in cold weather.

John Machin, *for Improvements in Boots and Shoes.* Dated 17th June, 1851. These improvements (old friends, without even new dresses), consist in affixing revolving heels to boots and shoes, so that by rotating them as they wear, a fresh surface may be exposed. The objection which, we understand, applies to all the schemes for revolving heels which have been hitherto tried, is, that the centre-pin becomes bent, so that the moveable part becomes jammed. Gutta percha heels offer such facilities for welding a bit on as they wear, that they appear more deserving of patronage, whilst they have the advantage of being much cheaper.

R. and F. Crickmer, for *Improvements in packing Stuffing-boxes and Pistons.* Dated July 3rd, 1851.

This improved packing consists of an elastic material, such as vulcanized india-rubber, enclosed in canvas, protected from wear by being enveloped in wire-cloth, or a thin perforated plate of metal. For stuffing-boxes, the india-rubber is extended, and slipped on over the rod; whilst for the packing of pistons, the india-rubber is compressed. In each case, its elasticity keeps the metal in contact with the rod or the cylinder. This, it will be seen, is carrying out a plan described in one of our early numbers, in which a sheet of brass is recommended to be interposed between the piston-rod and the hemp packing, by which a great saving of grease may be effected, and the durability of the hemp packing may be increased. Some of our first engineers also make use of a similar plan for pistons; a *thin* cast-iron ring being put next the cylinder, whilst the space behind it is filled up with gasket in the usual way. We have seen packings of this kind taken out of a sea-going steamer, in excellent condition, after six months fair wear, under 12 lbs. steam. This supposes, of course, that it is carefully done to begin with.

INSTITUTION OF CIVIL ENGINEERS.

January 20, 1852.

James Meadows Rendell, Esq., President, in the chair.

The Paper read was "On the Alluvial Formations, and the Local Changes, of the South-Eastern Coast of England. Second section,—from Beachy Head to Portland:" by Mr. J. B. Redman, M. Inst. C. E.

Westward of Beachy Head the effects produced by local variations in the beach were traced,—the "fulls" tailing across the outfall of Cuckmere Haven, and driving the outlet eastward, creating a barrier of beach at Seaford,—at an early period the outfall of Newhaven Harbour,—where an ancient outlet existed on the site of the present entrance, subsequently projected eastward, by the passage of shingle from the westward, until rendered permanent by piers. The recent degradation of the shore along Seaford Bay, from the shingle being arrested to the westward, and the unavailing attempt to stop this movement by blasting the cliff at Seaford Head, were noticed. The waste of the coast at Rottingdean, the modern changes at Brighton, the great variations in the outlet of Shoreham Harbour, until rendered permanent by artificial works, were examined, as well as the analogous effects on the coast generally at Pagham, across the entrance of which a spit had been formed, similar to those at the ancient harbours of Romney and Pevensey. The anchorage of the Park, off Selsey Bill, once presumed to have been a portion of the site of a Bishop's See, prior to its removal to Chichester, owing to the progressive waste of the shore. At the back of the Isle of Wight, the peculiarities of the land-locked harbours, and the protection afforded by the shore defences to Portsmouth harbour, so little altered in its general outline, since the time of Henry the Eighth, were described, as also the remarkable promontory called Hurst Point, many of the characteristics of which were similar to those of the Chesil Bank, Calshot Point, and other formations, such as a low flat shore to leeward, (eastward) and a highly inclined beach seaward, with a tendency to curve round to the northward and eastward, and eventually to enclose a tidal mere, or estuary. The elevation and size of the pebbles increased towards the extremity of these points, and in places on the sea slope an intermixture of coarse sand and shingle, which had become solid and homogeneous by age, cropped out through the modern beach. The remaining portion of the coast of Hampshire, and that of Dorsetshire, as far as Weymouth, were then minutely described, and the paper concluded with a particular account of the Chesil Bank, which in magnitude far exceeded all other formations of the kind, and which it was considered might be attributed to the waste of the great West Bay.

Numerous diagrams, compiled from ancient and modern maps, together with sections and sketches of the various alluvial spits along the coast, were exhibited, and it was shown, that all these local accumulations had many features in common, and were subject to the same alternating effects of loss and gain, and were the resultant of causes in constant operation, the whole exercising a most important influence on harbour and marine engineering generally.

In the discussion which ensued, in which Sir C. Lyell, Sir E. Belcher, Mr. Rennie, Capt. O'Brien, Mr. Scott Russell, and the Author, took part, the peculiarities of the different parts of the coast were still further described, and the formation of the moles of shingle were attributed, by some of the speakers to the action of the tidal currents, but more generally, by others, to the mechanical power of the waves alone, which appeared to account for the apparently anomalous fact, that the largest pebbles were always found on the summit and to leeward. Chesil, Hurst, and Dungeness beaches were referred to, as remarkable instances of results produced by such causes; and the effect of the severe storm of November, 1824, on the base of Hurst Beach, was alluded to.

A short account of Mr. Deane's Submarine researches on the Shambles Shoal, off the Bill of Portland, was read, describing that shoal to consist entirely of a bed of small broken shells, arranged in parallel shelves, or steps, instead of, as had been supposed, being formed of boulders and pebbles. This peculiar arrangement of light shells, at depths varying from 4 to 9 fathoms, must be the result of the action of the currents forming a spot comparatively without motion, and induced curious speculations as to the causes of the accumulation, and the effects that might be produced on similar aggregations by artificial works.

CORRESPONDENCE.

WOODEN SAILS FOR SHIPS.

To the Editor of the Artizan.

Sir,—In reference to the letter of "Inquirer," I beg to say, that more than a twelvemonth since, and before the *America* was talked of, I had a sail constructed entirely of thin boards, for a skiff, about 20 feet long, made lateen shape, and arranged something like a Venetian blind. I sailed her frequently on the river, and was much pleased with the practical proof she exhibited of going better to windward, and closer than any other boat of her size. She also reached and ran well; for the foresail and mainsail being in one triangular frame, I was able to turn them so as to get the full advantage of the wind. As you may imagine, I was a good deal laughed at before the experiment was tried, and all the knowing ones predicted that she would go "bodily to leeward," but afterwards admitted they were surprised at the result.

I was most afraid that, from the additional weight above, she would heel over very much; but, to my great astonishment, she kept more upright than with her ordinary light sail; and this result was most gratifying, as it proved that the belly of an ordinary sail impedes progress by holding wind instead of allowing it to slide off.

As my object in this experiment was to show that a flat surface was better than a hollow one for sails, and having succeeded, I got Mr. Gilbert of Limehouse, who has a patent for making very flat sails, to make me a mainsail for a yacht upon this principle, and which has given me great satisfaction.

I remain, Sir, yours obediently,

Blackwall, Jan. 15, 1852. W. P. BAIN, M.D.

ON THE MANUFACTURE OF FLAX HACKLES.

To the Editor of the Artizan.

Sir, — Being a reader of the *Artizan*, I thought, after reading your article on flax machinery, that a description of some of the hackles used might be useful to your readers. I make all the hackles for Mr. Marsden,

the patentee of what is called the "intersecting machine," which is the machine most in use for fine numbers of yarn from cut line flax. The hackles for this machine are much finer than any other in use. Mr. Plummer's not being in general use, I do not know anything of them. The hackles for Marsden's machine are all 9 inches in length by $1\frac{1}{2}$ inches in breadth, the number of rows in each hackle varying from one to four; two and three, however, are most in use. In most cases there are four gradations of hackles; one, which is very common, is 3, 6, 12, and 24 pins to the inch, or 27, 54, 108, and 216 to each row; the numbers of wire used for the above pins being numbers 14, 16, 18, and 23, the pins all being $1\frac{5}{8}$ inches in length. Latterly some have been made only $1\frac{1}{8}$ inch in length. Another gradation is 26, 32, 36, 42, and 50 pins to the inch, or 234, 288, 324, 378, and 450 pins in the row; only one firm, however, have used them so fine as 50 to the inch, Messrs. Marshall, in Leeds. Formerly the stocks were made of brass, but a few years ago, I introduced cross wood, covered with sheet-brass, which has been found to answer much better. Samples from 12 to 64 pins to the inch, I sent to the Exhibition, Class 6, No. 633; also two samples of hand hackles of 54 and 365 pins to the row, with 25 and 13 rows in each respectively. In the case of the 64 pins to the inch, the diameter of the wire is the 72nd part of an inch, so that great care is required in drilling, so that the holes are not run into each other.

I am, Sir, your most obedient servant,

EDWARD TAYLOR.

Kinghorn, Fife.

ON THE USE OF COAL TAR TO PREVENT CORROSION IN BOILERS.

To the Editor of the Artizan.

Sir,—Knowing your readiness to give publicity in your advanced and widely spread Journal to anything scientific and useful, I venture to hope that you will insert the following, which may perhaps not be uninteresting to your numerous readers connected with steam engines. I have been engineer on board of different steam vessels for several years, and have used coal tar in boilers extensively, but my method of applying it is rather different to Mr. Ashworth's, or the *scientific American.* I use it as follows:— To one gallon of coal tar add half a pint of spirit of turpentine; mix well together, and lay on when the boiler is empty. I find a common flat whiting brush is the best tool. I daub the boiler inside on every place come-atable; this done, I light a fire in each furnace, and warm the boiler gently. The boilers I have at the present time are tubular, with three furnaces in each, and once in two or three weeks I daub the upper tubes and end plates right thick, so that it runs down on to the lower tubes and fire boxes. I then, as I said before, light a fire in each furnace. Attention is of course required, as the fires burn up, so as not to over-heat the plates. The rule I go by is this: it is well known to every practical engineer that when the fires are first lit, a coat of soot adheres all over the fire box after the plates reach a certain temperature; on opening the furnace door, this coat of soot takes fire; it is then time to draw out the fire, or dash on a bucket of water, which is always at hand in the engine room of a steamer.

By the warming process, the tar runs over the whole suface of the tubes and fire boxes, and leaves a fine black japan on them.

I presume, Sir, that very few engineers would try the process I have described for the first time without fear and trembling for the safety of his boilers, but any one trying it will pronounce in its favour. I have followed the system, as described, nine years, which I am prepared to prove at any time.

I am, Sir, most respectfully yours,

"BOLD BUCCLEUCH."

ADMIRALTY FORMULA.

Specification *of certain particulars to be strictly observed in the construction of a pair of marine steam engines with paddle wheels, referred to in the Admiralty Letter on Her Majesty's Service,* 1845.

The tenders are to be made (in triplicate) on the accompanying printed forms, *every particular in which is to be strictly and carefully filled up,* and all drawings, models, and boxes containing them, are to be distinctly marked with the names of the parties transmitting them.

The whole weight of each pair of engines, including the boilers (with the water in them), the coal boxes, the paddle-wheels, the spare gear, the floor plates, ladders, guard rails, and *all other articles,* to be supplied under the contract, is not to exceed 190 tons.

The coal boxes (in the space of the engine room) are to contain eight days' coal, computed at 8 lbs. per horse power per hour, and at 48 cubic feet to the ton. Sufficient details of the coal boxes are to be shown in the drawing, to enable a computation of their contents to be made. In this computation, the space below the deck, to the depth of six inches, to be excluded, to allow for the space occupied by the beams, and for the difficulty of completely filling the boxes with coals.

To avoid the possibility of mistake in the dimensions given in the drawings furnished to the respective parties, it is to be understood, that,—

The length of the engine room in the clear is not to exceed	48 ft. 0 in.
Breadth of ditto	as shown in the drawing.
Depth of ditto	
The centre of the shaft above the water line ..	

The situation of ditto, as per drawing, or as near as can be.

The holding-down bolts are to be secured by nuts let into the sleepers, so as not to require the bolts to pass through the vessel's bottom; and the bolts are to have, at the lower end of their points, wrought iron washers about eight inches square, and one inch thick, placed between the nuts and the wood. Should this mode of security be inapplicable to the particular kind of engine proposed, the engineer is fully to describe any other secure mode which he may think the most advisable to adopt.

The pistons are to be fitted with metallic packings.

The blow-off pipes are to be not less than $3\frac{1}{2}$ inches in diameter; and their thickness not to be less than $\frac{1}{4}$ inch.

The thickness of the steam-pipes is not to be less than $\frac{1}{4}$ inch; of the bilge-pipes, not less than $\frac{1}{4}$ inch; of the feed-pipes, not less than $\frac{1}{8}$ inch; of the waste steam-pipes, not less than $\frac{1}{8}$ inch; and of the waste water-pipes (if of copper), not less than $\frac{1}{4}$ inch.

The cylinders are to be fitted with discharge or escape-valves at the top and at the bottom of each, for allowing the escape of water therefrom; the valves to have suitable metallic cases, to obviate the danger of persons being scalded by any escape of boiling water. Reverse valves are to be fitted to the boilers.

Each cylinder is likewise to be fitted with a separate movement and valve, for the purpose of using the steam expansively, in various degrees, as may from time to time be found eligible.

The air-pumps are to be lined with gun metal, of half an inch in thickness when finished.

The air-pump buckets are to be of gun metal, with packing rings.

The air-pump rods are to be of gun metal, of Muntz's metal, or of wrought iron cased with gun metal,

The threads of all screwed bolts, nuts, and pins, used in engines and boilers, and in every other part of the work furnished by the contractor, are to agree with the threads used in the steam department at Woolwich.

A small engine is to be fitted, capable of working one of the pumps for feeding the boilers.

Pipes to be fitted for supplying, in the event of a leak in the vessel, the requisite quantity of water from the bilge to the condensers.

The hand-pump to be made capable of being worked by the engine also, and to be arranged to pump into the boilers, on deck, or overboard; and to draw water from the boilers, from the bilge, or from the sea.

The feed apparatus to be complete, independently of any feed from a cistern above the deck, should such be fitted.

The steam pipes, and all other pipes, to be of copper, and their respective diameters to be specified in the tender.

A separate damper to be fitted to every boiler, and dampers to be fitted to the fronts of the ashpits.

Brine pumps, or some other equally efficient apparatus, with refrigerators, to be fitted to the boilers.

A small flat iron vessel to be fixed in one of the paddle-boxes, with two pipes, one communicating with the stoke hole, and the other with the boiler, for obtaining a small supply of distilled water from the boiler. Air tubes to be fixed in the coal boxes for ascertaining their temperature. Particulars will be furnished to the contractors on application to the captain-superintendent, at Woolwich Dockyard.

The boilers are to be tubular, having iron tubes of $2\frac{1}{2}$ or 3 inches outside diameter, and it is desirable that the upper part should not be a greater distance above the water line than circumstances render necessary. They are to be constructed in three or more separate parts, each of which may be used independently of the others. Sufficient details of the boilers are to be shown, to enable a calculation to be made of the area of fire grate, and of the fire and flue surface.

In the manufacture of tubular boilers, care is to be taken to leave sufficient room between the crowns and the lowest row of tubes, with mud hole doors in the front of each boiler, to admit a person into these parts, both for the purpose of cleaning them and of repairing them, without taking out the tubes. All mud hole doors to be on the inside of the boilers.

A space of 13 inches wide is to be left clear between the boilers and the coal boxes in every part. The boilers are to be placed on a bed of mastic.

The paddle-wheels are to be of the common construction, and to be fitted with suitable brakes. Braithwaite's disconnecting apparatus is also to be applied.

The power of the engines is to be 260 horses, calculated at 7lbs. effective pressure on each square inch of the piston; and the speed of the piston,

For	4 ft.	0 in.	stroke not to exceed		196 ft.	per minute.
,,	4	6	ditto	ditto	204	,,
,,	5	0	ditto	ditto	210	,,
,,	5	6	ditto	ditto	216	,,
,,	6	0	ditto	ditto	222	,,
,,	6	6	ditto	ditto	226	,,
,,	7	0	ditto	ditto	231	,,
,,	7	6	ditto	ditto	236	,,
,,	8	0	ditto	ditto	240	,,

All the necessary ladders for the engine room, together with fenders, guard rails, and floor plates, are to be included in the tender, and, likewise, the expense of trying and fitting the spare gear.

The expense of clothing (in the following manner) the cylinders, steam pipes, and boilers is also to be included in the tender.

The cylinders are to be covered with hair felt to the thickness of two inches. The felt is to be covered with thoroughly dried wood, and bound together by iron or brass hoops.

The steam pipes are to be clothed with felt, which is to be moulded with spun yarn, and then to be covered with canvass; the whole to be of such thickness as to be even with the flanges.

After it has been ascertained by trial that every part of the boilers is perfectly tight, two good coats of red lead paint are to be then put on them, and felt applied to the tops, sides, and ends, to the thickness of two inches, while the paint is moist. For the more convenient application of the felt, it is to be previously stitched to canvass for the purpose of holding it together. The canvass is then to be well painted and carefully covered with thoroughly dried one inch deal boards, having rabetted or grooved and tongued joints, and bound up to the boilers by suitable iron straps.

The coating of felt and boards on the top of the boilers or steam chest is to be kept at least 18 inches from the funnel, and the circular space between the coating and the funnel is to be covered with a three inch course of brick, set in cement, and surrounded and held together by an iron hoop, or this space may be filled up with mastic.

The boards and bricks on the upper parts of the boilers are to be covered with sheet lead, 4 lbs. to the square foot, so as to prevent any leaks from the deck reaching the felt.

N.B.—Parties contracting to supply machinery for her Majesty's ships and vessels, are to be bound in a penalty of £1,000, to complete their contracts at the stipulated periods; and it is distinctly to be understood, that it is their lordships' intention to enforce the bond in all cases where the machinery is not fixed and ready for trial at the time specified in the contract.

The time required for completing the machinery, so as to be ready to be put on board the vessel, is to be considered as commencing from the date of their lordships' acceptance of the tender.

And the period stipulated for fixing the machinery on board the vessel, is to be calculated from the date the vessel is placed in the hands of the parties for that purpose.

It is likewise to be understood, that if the weight specified in the tender be exceeded, the contractor is to forfeit £1,000, or their lordships are to be at liberty to reject the engines, the manufacturers paying £1,000 for the disappointment.

It is to be understood, that the practice of fixing new engines on board her Majesty's vessels at Woolwich Dockyard, is to be *entirely discontinued.* The ports to which their lordships will, for the convenience of manufacturers, allow vessels to be taken are those of London, Liverpool, Greenock, Glasgow, and Dundee, provided the places at which the vessels are to lie in those ports shall be named in the tender, and approved of by their lordships.

In all cases of vessels receiving their engines on board at any other port than that of London, a deduction of two per cent. will be made from the price of the engines named in the tender, as a compensation for the expense, wear and tear, and risk thereby incurred.

No charge will be allowed for transporting the vessel to the place where the engines are to be fixed on board; for coals in trying the engines *until they are complete;* for boats, anchors, men, lighters, pilotage, canal or dock dues, shipwright's work, or for any other expense whatever. The watching of vessels is to be performed, in future, by officers and men in her Majesty's service.—*Murray on the Marine Engine.*

ENGINES OF THE "GREAT BRITAIN," BY MESSRS. PENN AND SON.

Illustrated by Plate 2.

This noble vessel, after gallantly braving the wintry storms of the Atlantic, is now nearly ready for sea, and will soon be running between this country and New York, under the command of Captain Matthews. The repairs of the hull have been executed by Messrs. Vernon, of Liverpool, and the new engines and boilers are by Messrs. Penn and Son. They are, we believe, off the same patterns as those made for H.M.S. *Sphynx*. The plate, for which we are indebted to Mr. Bourne's "*Treatise on the Screw Propeller*," gives the details of the various dimensions, on which we shall have some remarks to make, after she has been tried.

THE LOSS OF THE AMAZON.

We have received a number of communications on this melancholy subject, but as they only proceed on hypothesis, we defer going into the details until the examination now being conducted by Captain Beechey on behalf of the Board of Trade is concluded. We may suggest that *accurate particulars* of the relative positions of the boilers and the bulk-heads, store-rooms, &c., would be very desirable, to enable a correct judgment to be formed on the cause of the accident.

TRIAL OF THE "ORINOCO."

The royal mail steam-ship *Orinoco*, W. Allan, acting commander, arrived at Southampton from the Thames on the 25th, having left Blackwall on Friday, shortly after noon.

The *Orinoco* was built at Northfleet (in Company with the *Magdalena*, the third vessel of the same class for the West India service), by Mr. Pitcher, and the engines are from the celebrated factory of Messrs. Maudslay, Sons, and Field.

Externally, the *Orinoco* very much resembles the *Amazon*, her great length, lofty rig, immense spread of canvass, and low funnels, giving her the appearance of a steam frigate of the largest class, and not of a mere merchant steamer. Great Britain has just reason to be proud of the energy and enterprise of great commercial associations like the Royal Mail, and other great Steam-Packet Companies, which can build and employ steam-ships of this class. Although adapted for the peaceful business of conveying mails, passengers, and cargo, yet the sterner necessities of war have not been forgotten or lost sight of, and, in the event of hostilities, these ships, when supplied with the armament which they are designed and able to carry, would be converted into gigantic and powerful steamers of war, formidable not alone for the heavy guns they would be able to use, but for the great speed they can attain, a speed superior to that of any steam ships of war in the British, French, or American navies. The *Orinoco* has, therefore, been pronounced capable of being armed with 26 guns, four of which, on the main deck, might be 10-inch Paixhan long range guns, of the heaviest size; the remainder short 32 or 24-pounders, as the case may be. Upon an emergency, a couple of long 68-pounders, on traversing slide carriages, might be fitted to the spar deck, if that deck were temporarily strengthened by a few additional supports for the purpose.

The dimensions of this noble ship are as follows :—Length between the perpendiculars, 270 feet ; length over all (figure-head to taffrail), 301 feet ; length on spar deck, 276½ feet ; breadth from out to out of paddle-boxes, 71 feet 10 inches ; extreme breadth, 41 feet 10 inches ; ditto for tonnage to a six-inch bottom, 41½ feet ; breadth moulded, 40½ feet ; depth of engine-room at shaft, 26 feet 1 inch ; depth from under side of spar deck, 33½ feet ; burden in tons, builder's measurement, 2,245 31-94ths.

The *Orinoco*, like the *Amazon*, has nine boats, four of which are Lamb's patent life-boats, 30 feet long and 8 feet wide, and calculated to carry 32 persons each. Two are swung forward over the fore sponson, and two over the after sponson. There are also two large cutters, 27 feet long, with 8 feet beam, each boat calculated to carry 35 persons, and pulled by 12 oars each. Besides this, there is one mail boat, 22 feet long, 6 feet beam, able to carry 18 people ; a gig, 25 feet long, 5 feet beam, able to contain 10 persons ; and a dingy (rather larger than that supplied to the Amazon), being 17 feet long and 5½ feet wide, and calculated to carry eight or nine people. These nine boats would be sufficient to provide for the safety of 234 persons.

We may remark here, that in the securing of the *Orinoco's* boats, the iron crutches, so much objected to in the *Amazon*, have been omitted. During the run round, an experiment was made with the forward starboard life-boats, particularly with a view to ascertain how quickly these boats might be cast loose and go clear of the sponson. The operation was performed in less than three minutes from the time the men were called on deck, unexpectedly and without previous notice, to make the attempt.

The *Orinoco* is propelled by two engines made by Messrs. Maudslay, Sons, and Field, of London, which are of the nominal aggregate power of 800 horses. These engines are on the patent double cylinder direct acting principle, and embrace all the most recent improvements applied to marine steam machinery. Each of the four cylinders are of 68 inches diameter, equal to two 98 inch cylinders such as are supplied to the ordinary side lever marine engines; and the boilers are eight in number, each boiler having three furnaces, and possess an aggregate evaporating power of 9,000 gallons of water per hour; the paddle wheels, 40 feet in diameter, are fitted with the patent feathering floats, which have been found so efficient and successful in their operation when applied to other steamers of this line.

Draught of water aft, 17 feet 9 inches; forward, 17 feet 6 inches; when leaving Blackwall having 400 tons of coal on board. It is calculated that with 1,100 tons of coals, and with cargo and stores all ready for sea, the *Orinoco* will have a draught of water of 21 feet on an even keel.

The magazine of the ship is fitted in a lead tank, and may, in the event of fire, be immediately flooded with water, from a pipe leading from the spar deck.

The *Orinoco* started from Blackwall at 1.30 p.m. on Friday. Two trials of her speed were made in Long Reach, on the first against the last of the flood tide ; and, tested on both sides at the measured mile, the distance was performed in 5 minutes 10 seconds, equal to a speed of 11.613 knots, about 12½ statute miles per hour, the engines making 13 revolutions with a pressure of 12 lbs. of steam in the boilers. A second trial gave a result of 5 minutes 33 seconds, equal to 10.811 knots, to which was added the influence of the tide, equal to half a knot, making a total of 11.311 knots. After remaining a short time off Gravesend, the *Orinoco* proceeded to the Nore, where she anchored for the night, performing the run thence, a distance of 23 miles, against a four-knot tide, in 1 hour 23 minutes, the engines making 13½ revolutions, the speed by Massey's log, when added to the adverse influence of the tide, giving a speed of nearly 12 knots, equal to 13 4.5 miles per hour.

When in the vicinity of Stokes Bay, advantage was taken of the opportunity to test the speed of the ship by several runs at the measured mile, the results of which were as follows:—

1st run, in slack water, 4m. 59sec., equal to 12.040 knots; 2nd, 5m. 9sec., 11.650; 3rd, 4m. 59sec., 12.040—revolutions 13¾, with 12lbs. steam.

Experiments were also made in turning the ship when under full steam, and she came round on the first occasion in 3m. 30sec., and on second trial in 2m. 30sec.

It will be seen by the above, that the *Orinoco*, on two trials, attained a speed of over 12 knots, equal to about 13½ statute miles in Stokes Bay. It must be remembered, however, that she was light, and that, when fully laden with coals, stores, cargo, &c., her rate of steam through the water will necessarily be considerably less.—*Times*.

THE EASTERN STEAM NAVIGATION COMPANY.

At a meeting to promote the completion of the Great Western docks at Plymouth, held last week, a committee was formed to procure subscriptions for the 6,000 guaranteed 5 per cent. shares of £10 each, which it had been resolved to issue, and which, it was alleged, would, with the amount authorized to be raised on debentures, fully suffice for the objects to be effected. The amount already expended was stated to be about £90,000, and an offer had been received to finish the undertaking for £78,000. Mr. Braine, the deputy chairman of the Eastern Steam Navigation Company, attended, and pointed out that unless the docks were completed it would be impossible for his Company to bring their vessels to Plymouth. He added, also, to show the necessity for immediate action on the part of the town, if they would secure the advantages contemplated, that the tenders for the second monthly mail to India and China would be decided upon at the end of February next, and that the Company, by arrangements which its directors had made on their own private responsibility, had already nearly completed one vessel at Bristol, and had laid down the keels and built the engines of seven others.

AFRICAN MAIL CONTRACT.

The contract for the monthly mail line of screw steamers to and from England and the West Coast of Africa, which was advertised by the Admiralty in September last, has been taken by Mr. Macgregor Laird. It is for nine years, at an average payment of £21,000 per annum. The places touched at will be Madeira, Teneriffe, Goree, River Gambia, Sierra Leone, Liberia, Cape Coast Castle, Accra, Whydah, Badagry, Lagos, Bonny, Calebar, Cameroons, and Fernando Po, making the total distance out and home 9,000 miles, which, including stoppages, will be performed in from 58 to 60 days. The speed of the vessels is to average 8 knots, and their size will be about 700 tons. It is satisfactory to add also that they are to be constructed of iron.

REVIEWS.

Suggestions for a Crystal College, or new Palace of Glass, for combining the intellectual talent of all nations; by W. Cave Thomas. London: Dickinson Brothers. 8vo. pp. 63.

Mr. Thomas is favourably known as the master of the North London School for drawing and modelling, and his experience in that capacity has led him to take up the entire question of education, one of the most important of the present day, and which cannot be too often discussed, so long as the combatants preserve that philosophical spirit which distinguishes Mr. Thomas's *brochure*. His arguments on the developement of animal organization, and the theory that man occupies, very probably, the "golden mean" in animated nature, will be found interesting to the student. Appended to these reflections, are some suggestions on a grand college, in which provision is made for mental and physical education in every branch of science and art. Institutions of this class, however, are not of mushroom growth, and we should prefer seeing our existing educational establishments increased in usefulness, to expending all our available energy in beginning *de novo*.

Rudimentary Treatise on Marine Engines and Steam Vessels; by Robert Murray, C.E. London: Weale.

Mr. Murray has been successful in producing a very useful compilation on the management and construction of the marine engine, as applied to the paddle wheel and the screw. Amongst the original information will be found the result of Lord Dundonald's experiments on slow combustion in marine boilers, the experiments at Woolwich dockyard on the same subject, tables of velocities of paddle wheels, a comparison of the efficiency of different vessels for scientific purposes, in which the number of tons of displacement which 100 indicated horses power will propel at ten knots, is proposed as the standard of comparison. There are also the government forms of specifications of paddle wheel and screw engines, one of which we have given at another page. We perceive that the author has made a very free use of our columns, without, however, acknowledging the source from which his information is derived.

Text-Book of Geometrical Drawing; by William Minifie. Third Edition; Baltimore, U.S.; imp. 8vo. pp. 127. Minifie & Co.

Geometrical drawing is, unhappily, as yet so little established as a branch of education in this country, that there is a corresponding dearth of any good works on the subject. The best thing of the kind we have seen is Bolton's *Drawing from Objects*. The present work is of a similar character, but on a more extensive scale. Mr. Minifie is teacher of drawing in the High School of Baltimore, and this work is the result of his experience in that capacity. The definitions and rules of geometry are explained, as well as the uses of the various instruments. This portion, which may be called the elementary, is succeeded by examples of the application of the rules to Architecture, Carpentry, and Machinery. The last subject seems to demand a special treatise for students who wish to follow it up. The text has a practical tone about it which we admire, whilst the illustrations, which are numerous, are on copper, and particularly well executed. In paper and typography, it is equal to any work of the same class published in this country, which is more than we can say of the Government Patent Office Report, noticed at another page, and which, as a Government publication, ought certainly to set a better example.

Cyclopædia of Useful Arts; edited by Charles Tomlinson. Royal 8vo. Parts 1 to 5. George Virtue: London and New York.

We are indebted to the Great Exhibition for this work, which promises to be a valuable record of the present state of the arts and sciences. It takes a popular view, it is true, but from the care with which the authorities are selected and *quoted*, we have no fear that correctness is sacrificed in the attempt to make it available for the million. It is just the sort of work for a Mechanics' Institute, and may tempt many a reader to drink deeper from the fountain of science.

Dynamics, Construction of Machinery, Equilibrium of Structures, and the Strength of Materials; by G. Finden Warr. Library of Useful Knowledge. 8vo. pp. 296. London: R. Baldwin.

The title is almost sufficiently explanatory of the objects of this work, which is to be commended not less for the lucidity of its language, than for its correctness in practical detail, the latter a virtue but little known in popular works. Amongst the mechanism detailed, will be found the steam-hammer, Whitworth's latest improvements in tools, and the new printing machines. Amongst the constructive examples are the tubular bridges, and the experiments by the Government Commission on the use of iron in railway structures. At another page we have extracted an article on Freiburg Suspension Bridge.

The First Step in Chemistry. By Robert Galloway, F.C.S. 8vo. pp. 91. London: John Churchill.

This appears to us one of the best elementary works on the subject that we have seen, and their name is legion. The style is simple and terse; in fact, the matter reminds us of the notes we have been accustomed to make on any subject on which it was desirable to enlarge in the class-room. Exercises are appended in the "catechism" form, a method which is always the most acceptable to the student, and attractive to the general reader.

THE ENGINEERS' STRIKE.

The struggle between capital and labour still continues, and, we regret deeply to say, seems likely to continue. We can add nothing to what we said last month on the points of over-time and piece-work. Their justice is admitted, we have reason to know, by many of our readers of the artizan class, whose only answer is, "We must do as the others do." Several orders, intended for London firms, have already been transferred to the Clyde, and we find writers in France urging French engineers not to let slip such a favourable opportunity of profiting by the infatuated blindness of English engineers. We extract the following from a circular issued by the Employers' Association:—

Ours is the responsibility of the details; ours the risk of loss; ours the capital, its perils and its engagements. We claim, and are resolved to assert the right of every British subject, to do what we like with our own, and to vindicate the title of our workmen to the same constitutional privilege. Artizans and their employers are respectively individuals—each legally capable of consent—each severally entitled to contract. Our agreements for their service are made with them in their separate, not in their aggregate capacity. They have labour and skill to sell; we have capital to employ it and to pay it. Who, then, or what should stand between these two single parties to a lawful bargain, and dictate to the buyer what he should give, or control the seller in the conditions of his service? In the most literal sense we are the *customers* of the working classes; and the interference of self-constituted arbiters with the internal economy of our establishments is not less preposterous than would be a command from our baker as to the number or the price of loaves we should consume; or a mandate from our butcher as to when we should dine and what should be the meat. We altogether ignore the proposition that we should submit to arbitration the question, whether our own property is ours, and whether we are entitled to be the masters of our own actions.

Our business renders us more obnoxious to strikes than any other, and renders precautions against them more imperative. The heavy expense of our machinery and tools, and the peculiar character of the work we produce,

render over-time, piece-work, and irregularity of employment an unavoidable and certain incident of our calling. We cannot, like the spinner, the weaver, or the cloth-worker, manufacture on speculation, and produce without order, certain that ultimately the article will be required, and must always be in demand. The same yarn will weave to any pattern, the same cloth will fit any coat;—but we can only produce to order, and we must produce our commodity *when* it is ordered. Our customers require all their purchases for a special purpose, and at a particular time. Perhaps they are useless to them, unless supplied when stipulated—certainly they will cease to employ us if we fail to finish to our time. Belgium and Germany are not far off. Piedmont and Switzerland are quite within competitive distance. The United States begin to manufacture for themselves, and even to meet us in neutral markets. France, but recently our largest customer, is now our most formidable rival, and, in spite of her disadvantages in reference to the raw material, almost entirely supplies her own demand. If we are to enjoy an equality of advantages with our competitors in the common market of the world, we must consent to bind ourselves to complete our contracts on a day early, and certain. Short-sighted unionists, aware that we work against time, some of us under actual penalties, all of us under peril of loss of trade if we fail in punctuality, induce the men, when the master is in his greatest difficulty, to take advantage of his necessities to wring from him humiliating and unjust concessions, which leave him without profit, or threaten him with loss. Afraid to subject himself to the repetition of practices which present to him only the alternative betwixt heavy fines for failure of contracts, or loss of business character, and exorbitant remuneration for inferior skill, the master declines otherwise profitable orders, draws his operations narrower, and diminishes the demand for labour; and this dread spreading generally through the trade, and too amply justified by offensive interference, forced upon every master, induces a universal disposition to decline the most valuable custom, and thereby seriously to depress the business, and circumscribe the employment of the country.

It will readily occur to all who have the slightest acquaintance with commerce, that production carried on almost entirely to order, and limited as to time in its completion, cannot be conducted without *over-time*, in a great measure as systematic as the punctuality of the time-orders received—that as masters are taxed from 25 to 50 per cent. more for the extra hours, when the service is least valuable, nothing but necessity would induce them to adopt the practice—that from the very nature of mechanical operations, which are almost as dependent on each other, and as successive in their processes as the inanimate machinery they fabricate, the non-completion of one article may keep many persons idle who are waiting to commence some department of machinery to which the former is indispensable; and that as the machinery and tools used in engineering involve vast outlay of capital—the only option left to the employer is to work one set of tools beyond the usual hours of labour, or to erect another set at an exorbitant expense, which, even if it would serve the purpose, which it could not, must come out of the price of the work it executes; in which case demand is discouraged, and customers are driven to foreign markets, and by their withdrawal the demand for employment is destroyed.*

It is under these circumstances that the employers in Lancashire and in London have, *by pre-concert, simultaneously* received notice from the ostensible representatives of 15,000 of our artisans, that "they have come to a resolution to abolish the practices of over-time and piece-work;" and in "those cases where over-time is really necessary, in cases of break-downs or other accidents, all time so worked over, to be charged and paid at the rate of double time." The true intent and meaning of these conditions is this,—that where a master sustains the heavy loss of breaking a highly expensive instrument, he shall, in addition to his misfortune, be fined by our artisans double wages to repair it, although the earnings of perhaps a thousand of their fellow-mechanics may depend on the immediate resumption of its working. For the protection of our customers, there is no sacrifice which we will not cheerfully bear, rather than submit to this extortion.

Many of ourselves have traced their rise from the condition of the employed to that of employers to the opportunites afforded by piece-work, which enabled them to become small contractors, and thereby to avail themselves of the rewards of their directing skill. As it is the fairest and least fallible test of the value of labour, and best enables the master to make his estimates with security, so it is the line which measures off the expert and industrious workman from the lazy and unskilful; and, above all, it is the lever by which patient merit and superior intelligence raises itself above the surrounding level, and enables society to reward and to profit by mechanical genius, and energy, as well as respectability of character. All classes, in nearly every avocation, have occasionally to work over-time—the Prime Minister perhaps the most—the successful physician or the greatest lawyer the most slavishly. But men of any merit voluntarily set the task to themselves—those of the mechanic class earnestly desire it; and so far is either that or piece-work from being regarded as an oppression, our experience as masters is, that in the eyes of mechanics, as a body, it is viewed as a positive objection to an establishment that it does *not* afford opportunity for working over-time. The real objection to piece-work, we fear, is, that it protects the masters against those who are indisposed to give a fair day's work for a fair day's wages.

It has been publicly announced, that the operatives intend starting shops of their own, in the event of the employers keeping their works closed; and of course, if the men or their advisers have discovered any improved method of conducting an engineering business, so as to make a greater profit than previous capitalists have done, the public cannot but be benefitted by the competition. One thing, at all events, is certain, that there is no lack of concerns in the market for them to choose from. Of these, there are six in London and the vicinity alone, besides others at Liverpool, Bristol, &c., the majority of them old established concerns; which would absorb sums varying from £10,000 to £50,000 each, to put them in working condition. The reason for this is a very simple one—wages on the Clyde are about 25 per cent. lower than in London, and there is no concealing the fact that the Scotch engineers are gradually drawing the trade away from London, and the ultimate effect will be that the large London houses will have to open country establishments, or give up business altogether. Messrs. Boulton and Watt have always had their works at Birmingham, and their office in London, and Messrs. Miller and Ravenhill have recently opened a ship-building establishment on the Tyne. The London trade will thus be confined to repairs, which can only be done conveniently on the spot where they are required, and the great bulk of the workmen will have the option of "three courses"—either to work in the country at country wages, to change their trade, or to emigrate. We only hope they may reflect before it is too late.

BOILER MAKING IN LANCASHIRE.

Our Lancashire friends, we find, cannot settle down to any definite form of boiler. We know what a "Cornish boiler" is, and Mr. Armstrong tells us there is a "London boiler," but what a "Lancashire boiler" is, nobody will venture to say. Cornish boilers were tried in Lancashire, but were not found so applicable for inferior coal, owing to their limited area for fire-grate. This led to the introduction of the double-flued, or Fairbairn's boiler, which answered for a time, until Messrs. Galloway changed its character by uniting the furnaces behind the bridge, and by introducing water-tubes to give more heating surface in the same capacity. Two or three explosions set some of the more timid in search of locomotive boilers, but the first cost of these will always operate against their extensive introduction. A new idea was then started, "Enlarge the fire-box, and remove the tubes further from the intense heat, to make them last longer." Two

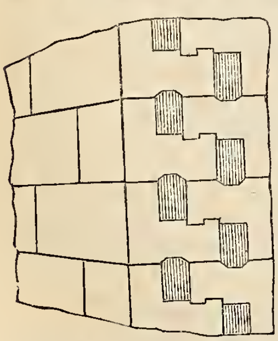
* Many illustrations will occur to the professional reader, of the impossibility of procuring a substitute for, or dispensing with the use of over-time in a trade which is so peculiarly dependent for orders on season and punctuality. Railway engines must be supplied to time, to prevent the confusion of the whole public arrangements; and as the nature of the work will not admit of the access to it of more than a certain number of hands, it is impracticable to avoid irregularity or protraction of the hours of labour. Proprietors of steamers on the Rhine, the Thames, or the Clyde must have new steamboats ready *before the travelling season*, else the profits they would earn would be lost, and the order, therefore, would not be given, except under obligation to complete the vessels in proper time, which may only be possible by working over-hours. Whole fleets of steamers may be damaged by winter storms, and to dispatch mails with punctuality, the repairs must be pressed forward night and day.

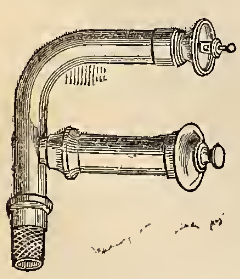
well-known engineers have followed out this idea, Mr. Holcroft of Manchester, and Mr. Hick of Bolton. The former, we believe, was in the field first, and registered a design for what we may call a "twin boiler," consisting of an ordinary double-flued boiler, the flame from which is carried through another cylindrical boiler, placed alongside of it, filled, within a due distance of the water-level, with small tubes. This plan had the advantage, that both ends of the tubes were accessible, and that the multitubular boiler could be readily put in or taken out, without disturbing the other. Mr. Hick has just specified a patent for a slight variation of the same idea; the only difference being that the two boilers are placed end to end, with a chamber between them lined with fire-brick, to render the combustion of smoke more perfect. Neither of these plans appear to us to possess any material advantage over Messrs. Galloway's water-tube boilers. The deposit of scale on the small tubes appears likely to give trouble. On this point we shall collect some information for an ensuing number.

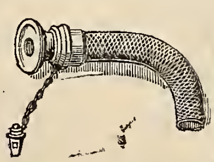
Mr. D. Mushet, *versus* "The Artizan."—Our attention has been called to a series of letters in the *Mining Journal*, under the signature, D. Mushet, in which the writer attempts to deny the correctness of an opinion expressed by the conductor of this journal in 1844, on the inventions of Mr. Craddock. With the correctness or incorrectness of that opinion we will not now deal; we may, perhaps, do so on a future occasion. There is another point, however (not at all affecting that opinion), which we should like to see cleared up:—Mr. Mushet states that Mr. Craddock, demurring to the opinion so expressed, "replied in his usual dispassionate style." This answer did not appear, neither any usual notice to correspondents; but Mr. Craddock received a private note from the editor stating, that "on the remittance of £5 his answer should be inserted." If this means anything it means, that the editor of this journal required a bribe of £5 to induce him to give insertion to an article, the tenor of which was contrary to his convictions. As the present conductor had, at the time mentioned, no connexion with the *Artizan*, it is impossible for us to do more than disclaim any knowledge of the note in question, nor is it easy to obtain evidence on what might take place eight years ago. We have only, therefore, one request to make (and from the courtesy displayed in Mr. Mushet's communications, we feel sure that he will oblige us), which is, that he will publish the *whole* of the note, of which he gives what purports to be an extract. We trust that it will throw some light on the subject.

NOVELTIES.

Hollow Brickwork.—The objection to the hollow bricks, as hitherto made, has been, that in the manufacture the core could not be supported except by a thin bar, which, as the brick issued from the die, did, in fact, cut it in halves, to be afterwards joined by the cohesion of the clay. But, as might be expected, the joint was always weak, and the bricks frequently split at that point. The annexed sketch shows a plan, registered by Mr. T. Paris, of Barnett, for moulding *solid* bricks, so that, when laid together, they will form *hollow brick-work*. These bricks are made without a core, and therefore obviate the difficulty above mentioned. They can also be made of any clay, and can be burned in a clamp, which will render them much cheaper. There can be no question about the perfection of the bond which they form, and, in fact, with a little sand to fill up the crevices, they would be admirably adapted for temporary buildings of all kinds.







Whishaw's Telekouphonon. — The use of speaking tubes is rapidly spreading, and after once being introduced into a house, the inmates wonder how they could ever have existed without them. The accompanying sketch represents an arrangement invented by Mr. Whishaw, the telegraphic engineer, and manufactured by Messrs. Kepp, of Chandos Street. The object is to show, in a room where there are a number of mouth-pieces, from which the signal proceeds. Each mouth-piece has a stopper, consisting of a whistle, in the centre of which is a little spindle with an ivory button on the end. When the sender b[lows] down the pipe, it whistles to call attention, and forces out the ivory butt[on] to distinguish the mouth-piece. In long lengths of pipe, a difficulty is experienced in forcing the air by the lungs, and accordingly a cylinder and piston, forming a simple air-pump, are provided, by a single stroke of which the whistle is at once sounded.

LIST OF ENGLISH PATENTS.

From 31st December, 1851, to 22nd January, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Robert Beck Froggatt, of Sale Moor, Chester, manufacturing analytical chemist, for improvements in the preparation of certain compounds to be used for the purpose of rendering woven and textile fabrics, paper, leather, wood, or other materials or substances waterproof and fireproof, and also in machinery or apparatus employed therein. December 31.

Francis Hastings Greenstreet, of Albany-street, Mornington-crescent, for improvements in coating and ornamenting zinc. December 31.

George Gwynne, of Hyde Park-square, Middlesex, Esq., and George Fergusson Wilson, managing director of Price's Patent Candle Manufactory, Belmont, Vauxhall, for improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night-lamps, and soap. December 31.

George Collier, of Halifax, York, mechanic, for improvements in the manufacture of carpets and other fabrics. December 31.

Francis Clark Monatis, of Earlstown, Berwick, builder, for an improved hydraulic syphon. December 31.

David Napier, of Millwall, engineer, for improvements in steam-engines. December 31.

Thomas Barnett, of Kingston-upon-Hull, grocer, for improvements in machinery for grinding wheat and other grain. January 8.

Joseph Addenbrooke, of Bartlett's-passage, London, envelope manufacturer, for improvements in the manufacture of envelopes, and in machinery used therein. January 8.

Charles Dickson Archibald, of Portland-place, Middlesex, Esq., for improvements in the manufacture of bricks and other articles made of plastic materials, and in cutting, shaping, and dressing the same, as also stone, wood and metals, and in machinery and apparatus employed therein. (Being a communication.) January 8.

William Cook, of Kingston-upon-Hull, working copper-smith, for certain improvements in the construction of steam engines, consisting of a rotatory circular valve for the regular admission of steam from the boiler alternately into the chambers of the two cylinders of double-acting engines. January 12.

Alcide Marcellin Duthoit, of Paris, France, statuary, for an improved chemical combination of certain agents for obtaining a new plastic product. January 12.

Robert John Smith, of Islington, Middlesex, gentleman, for certain improvements in machinery or apparatus for steering ships and other vessels. January 13.

Jean Antoine Farina, of Paris, proprietor, for a process for manufacturing paper. January 13.

James Aikman, of Paisley, Renfrew, North Britain, calenderer, for improvements in th[e] treatment or finishing of textile fabrics and materials. January 20.

James Macnee, of Glasgow, North Britain, merchant, for improvements in the manufa[c]ture or production of ornamental fabrics. January 20.

Thomas Kennedy, of Kilmarnock, North Britain, gun-manufacturer, for improvements i[n] measuring and registering the flow of water and other fluids. January 20.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain i[m]provements in treating fibrous substances. (A communication.) January 20.

Henry Graham William Wagstaff, of Bethnal-green, Middlesex, candle-maker, for i[m]provements in the manufacture of candles. January 20.

Peter Wright, of Dudley, Worcester, vice and anvil manufacturer, for improvements in the manufacture of anvils. January 20.

John Whitehead the younger, of Elton, near Bury, Lancaster, dyer and finisher, and Robert Diggle, of the same place, foreman, for improvements in bleaching and dying, and in washing, scouring, and other processes connected therewith. January 20.

George Lowe, of Finsbury Circus, London, civil engineer, and Frederick John Evans, of Horseferry-road, Westminster, civil engineer, for improvements in the manufacture of gas for the purposes of illumination, and of improvements in the purification of gas, and of improved modes of treating the products arising from the manufacture of gas. January 20.

Frank Clarke Hills, of Deptford, Kent, manufacturing chemist, for improvements in manufacturing and purifying certain gases, and in preparing certain substances for purifying the same. January 22.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in railways and locomotive engines, which said improvements are also applicable to every kind of transmission of motion. (A communication.) January 22.

Edward Tyer, of Queen's-road, Dalston, gentleman, for certain improvements in the means of communication by electricity, and apparatus connected therewith. January 22.

James Pillans Wilson and George Fergusson Wilson, of Wandsworth, gentlemen, for improvements in the preparation of wool for the manufacture of woollen and other fabrics, and in the process of obtaining materials to be used for that purpose. January 22.

Walter Marr Brydone, of Boston, for improvements in apparatus for signal and other lights for railways. January 22.

DESIGNS FOR ARTICLES OF UTILITY.

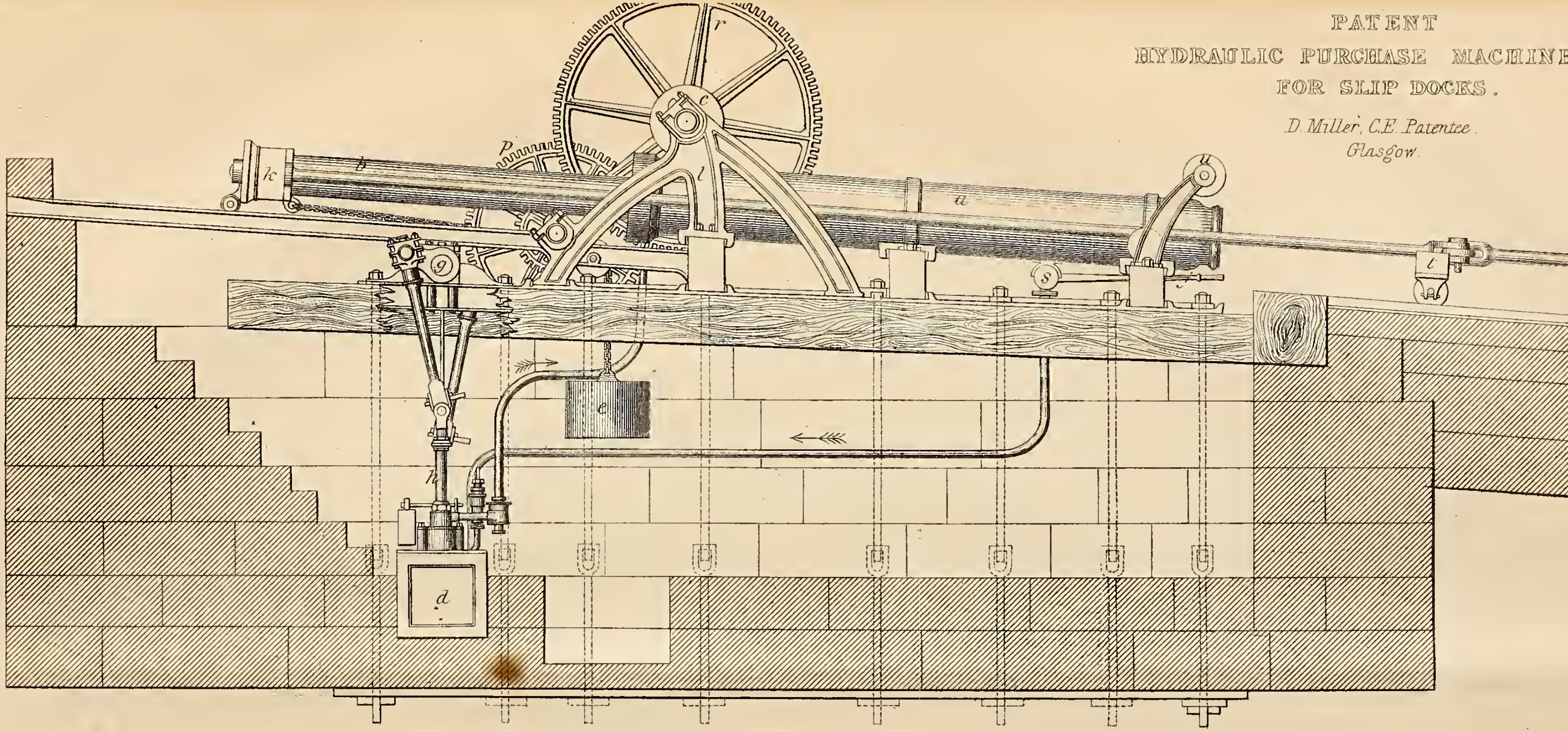
From the 26th December 1851, to the 22nd January, 1852, inclusive.

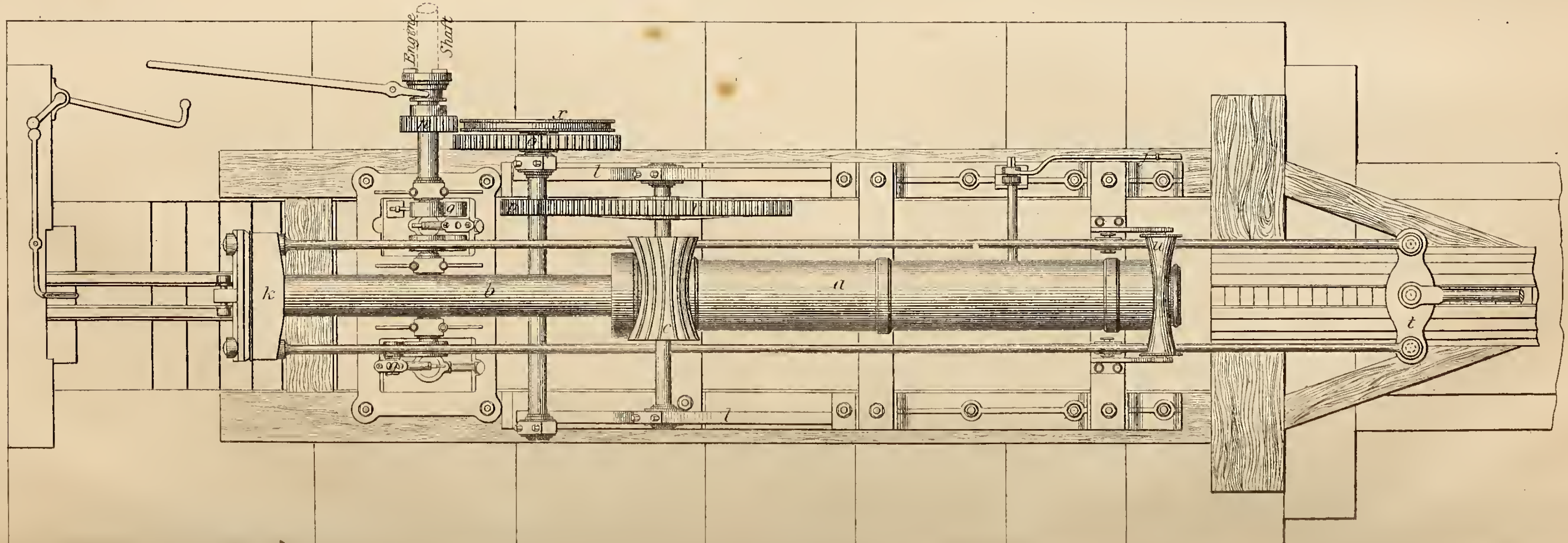
December 26, 3067, James Black, Edinburgh, "Paper cutting machine."
„ 27, 3068, F. T. Jones and Co., London, "Moulding to be used as a picture-rod."
„ 27, 3069, W. Peech, Sheffield, "Non-equal shears."
„ 29, 3070, J. Chesterman, Sheffield, "Double expanding and contracting spanne[r]."
„ 30, 3071, Henry Kearsley, Ripon, Yorkshire, "General tile-screening or grindi[ng] and brick-machine."

1852.
January, 1, 3072, George N. Haden, Trowbridge, "Hand hard-labour machine."
„ 1, 3073, J. Thornton and Sons, Birmingham, "Railway-carriage roof-lamp."
„ 2, 3174, John Ferrabée, Strond, "Grass-cutter."
„ 2, 3175, John Hughes, Lee, Kent, "Nursery yacht."
„ 2, 3176, Victor Angiers, Fitzroy-square, "Design for brushes."
„ 10, 3077, Walsh and Brierley, Halifax, "Double bar brace-slide."
„ 12, 3078, J. and T. Brown, Bradford, "Pressing lever."
„ 12, 3079, T. Johnson, Manchester, "Compound spring for a printing-press."
„ 12, 3080, G. Lewis, Leicester, "Lock."
„ 13, 3081, W. Pearse, Tavistock, "Roasting-jack."
„ 13, 3082, R. Gordon and J. Thompson, Stockport and Manchester, "H[o] wrought-iron yarn-beam, back-roller, and cloth-beam."
„ 14, 3083, S. Samuel, Houndsditch, "Cap-peak."
„ 16, 3084, J. Humphreys, Lancaster, "Presser-mould."
„ 17, 3085, T. G. Cressall, Finsbury, "Steam-lock."
„ 20, 3086, S. Hood, Upper Thames-street, "Stable-fitting for loose-box."
„ 20, 3087, W. Coulson, York, "Morticing machine."
„ 22, 3088, H. Wilkinson, Pall-mall, "Self-expanding solid rifle bullet."
„ 22, 3089, Stephen Webb, of the firm of Walker and Webb, Oxford-street, "Kn[ee] siphon, or fetlock boot."

PATENT
HYDRAULIC PURCHASE MACHINERY
FOR SLIP DOCKS.

D. Miller, C.E. Patentee.
Glasgow.





W. K. Whytehead, C.E. del.

D. Allard sc.

THE ARTIZAN.

No. III.—Vol. X.—MARCH 1st, 1852.

PATENT HYDRAULIC PURCHASE MACHINERY FOR SLIP DOCKS.

Daniel Miller, C.E., Patentee, Glasgow.

Illustrated by Plate 4.

The efficiency of slip docks, and the facility with which they can be constructed, have led to their general adoption, both in this and in other countries. The cost of their construction, compared with dry docks, is very small, and they possess many other advantages.

A slip dock consists of three principal parts: the inclined plane, or "slip," running down into the water, on which are placed three or more lines of massive cast-iron rails on strong foundations; the carriage or cradle, upon which the vessel is hauled up, provided with truck wheels having flanges to guide them on the rails, and also with palls to fall into the rack on the inclined plane; and the purchase machinery at the top of the slip by which the motive power is brought up to the required degree for hauling up the carriage with the ship upon it,—the connection between the carriage and the machinery being formed by a series of iron traction rods united by bolts and coupling links. It is upon the last part of the slip that the improvement to be described has been effected, the main feature of which is, the application of hydraulic power. The purchase machinery used hitherto for bringing up the power, consists of a system of spur and pinion wheel geering, which transmits the power to a barrel or drum on the last spur-wheel, the revolution of which draws round it a short pitch chain, attached to the iron traction rods leading down to the carriage.

The Patent Hydraulic Purchase Machinery, invented by D. Miller, Esq., civil engineer, of Glasgow, has been carried into successful operation at the large slip dock recently constructed at the harbour of Glasgow, on the Clyde, by Messrs. R. B. Bell, & D. Miller, C.E.

The accompanying engraving represents the purchase erected there, which was made by Messrs. S. and H. Morton, engineers, Edinburgh. As it had to be made to suit foundations which had been prepared for purchase machinery on the old principle, the arrangement had to be made accordingly, or a different one might probably have been adopted.

Referring to the engraving, *a* represents a massive cylinder of cast-iron placed at an inclination corresponding to that of the slip, and supported on cross bearers which are firmly bolted down to the foundation of masonry. It is fitted with a moveable ram, *b*, working through cupped leathers at the neck. Two side-rods proceed from the cross-head, *k*, on the end of the ram along the sides of the hydraulic cylinder, to another cross-head, *t*, where the traction rods are attached, connecting it with the carriage on which is the vessel to be drawn up on the slip. The motive power is a steam engine, placed on a separate foundation alongside, but which is not shown. The engine shaft puts in motion the two cranks, *g g*, which work the plungers, *h h*, of the pumps fixed in the cistern, *d*. These pumps have each two plungers, the one inside the other, so as easily to admit of a change of power, according to the size of vessel to be hauled up. *e* is a weight connected by a chain, winding round a roller, to the cross-head of the ram, for the purpose of drawing the ram back again into the cylinder after it has completed a stroke. In order to avoid having the pit, into which the weight descends, of an inconvenient depth, the roller is made of two diameters, that part of the chain from the cross-head to the roller winding round the larger diameter, and the part descending into the pit round the smaller diameter. *s*, is a large cock worked by the lever, *j*, for discharging the water from the cylinder back to the cistern.

Mode of Action.—The carriage having been run down the inclined plane, or slip, into the water, and the vessel properly blocked up and secured upon it, the connection between it and the cross-head of the purchase is formed by the traction rods. The ram being supposed to be at the commencement of its stroke, the clutch on the engine shaft is put in gear, by which the pumps are put in motion, and force the water from the cistern, *d*, into the hydraulic cylinder. The ram is thereby made to move steadily up out of the cylinder (with a force in comparison with the steam engine or other actuating power, as the area of the forcing-pumps to the area of the ram), and, by means of the side rods between the two cross-heads, communicates the motion to the traction rods connected with the carriage, which, with the vessel upon it, is hauled up on the slip. When the ram has moved out of the cylinder the length of its stroke, it is stopped by a man at the lever, *j*, turning the discharge cock, *s*, which allows the water to escape from the cylinder back to the cistern; the traction rod nearest the top is then removed, and the ram is immediately drawn back into the cylinder by the descending weight, *e*. The next traction rod being now taken hold of by the cross-head, *t*, the same action again takes place, and the ram moves up to the end of its stroke, when another traction rod is knocked off, and the ram returns to be attached to another, and so on. By a succession of these movements, the carriage, with the ship upon it, is steadily and quickly drawn up on the slip to the distance required.

For drawing up the empty carriage, a chain barrel, *c*, supported on the standards, *l l*, is used, which is worked by the sliding pinion, *n*, on the engine shaft, putting in motion the wheels, *o*, *p*, and *r*, the last of which is on the barrel shaft. The chain from the barrel passes over a guide roller, *u*, at the lower end of the cylinder. This apparatus is also used for letting down the empty carriage into the water, preparatory to taking on a vessel, in which case the brake, *x*, is employed to regulate the descent.

The advantages of the hydraulic purchase will be at once apparent to all practical persons accustomed to machinery working under heavy strains. In the purchase machinery on the old principle the whole strain in drawing up a ship being sustained by the bearings of the shafts and the teeth of the wheels, a great amount of friction is produced, causing much loss of power and wear and tear; but in the hydraulic purchase, as the whole strain is exerted in a line with the ram, no surfaces are brought in contact to produce these disadvantageous effects.

One of the great advantages of the hydraulic power is the smoothness and uniformity of working which may be attained, and the ease with which it may be managed; all the attendance that the machine requires is, that the lever, *j*, may be raised by one of the men who remove the traction rods, each time that the ram gets to the top of its stroke, as, by turning the cock, *s*, the machine can be stopped or set on, and the speed decreased or increased with perfect ease; and as the engine and pumps work all the time that a ship is being hauled up, there is no trouble in clutching or unclutching the engine shaft. The speed of the ram, with the large pumps working, in taking up vessels of 500 tons register, is twelve feet per minute, and when ships of 800 or 900 tons register are taken up, with the small pumps working, the speed is six feet per minute. No time is lost by the return of the ram to take a fresh hold, as it comes back as quickly as the men can remove the rods.

It is a sufficient proof of the efficiency of the hydraulic purchase, notwithstanding that it was the first one erected, and, therefore, could scarcely be expected to be made perfect at once, that the machinery on the old principle, which had been first ordered for the new slip dock at Glasgow, and was lying ready to be put up if the hydraulic purchase did not work satisfactorily, was thrown aside, thus incurring much additional expense on the part of the proprietors of the slip, in order to secure the new plan.

The construction of slip docks for taking up ships of very large size has been hitherto retarded by the great expense and complication necessary for bringing up the power by the system of wheel-work, and the difficulty of making it sufficiently strong to withstand the enormous strain to which it is subjected. By the hydraulic plan, however, there is now no limit to the size of ships which may be taken up, and slip docks may be constructed by which ships or steamers of 3,000 tons register or upwards may be taken up with the greatest ease, and with as little injury as they would receive resting in a dry dock.

THE IRISH DIFFICULTY AND ITS SOLUTION.

FLAX-COTTON AND BEET ROOT SUGAR.

(Continued from page 24.)

Having already indicated the extensive field which exists for the employment of Mr. Claussen's process for the manufacture of flax-cotton, we must take leave of the subject until the Companies now formed for carrying out his invention have fairly commenced operations, in which they have our best wishes for success. Experiments on the large scale are needed to show the precise profit which may be expected from the use of a material, as yet new to the cotton-spinning interest, and for these we shall not have long to wait if the further progress of the works meets with no unexpected obstruction.

We now come to the second of the proposed remedies, the cultivation of Beet-root and the production of Sugar from the saccharine matter which it contains. The same conditions have to be fulfilled in this, as in the former case. Is the climate of Ireland suited to the growth of Beet-root? Can the sugar be produced at such a price as will compete with the slave-grown sugar of the West Indies when all the protecting duties are removed?

To the first of these questions a unanimous reply is given in the affirmative, by those well qualified to judge. We shall not, therefore, waste time in producing authorities. The second question involves a number of points on which there exists the usual difference of opinion, and each requires analysing before we can safely draw any inferences from them.

Considerable stress is laid by the advocates of Beet-sugar upon the fact that its manufacture has been steadily progressing on the continent, and it is fairly argued that our superiority in machinery ought to place us in at least as good a position as our continental neighbours. For the following information we are indebted to Mr. Seymour's work:—

"First—as to the quality of Beet-sugar—the opinion of two leading authorities in chemistry may be quoted with reference to the quality of the sugar extracted from the beet, as compared with that of the cane:—'Sugar,' writes Dr. Ure, 'extracted either from the cane, the beet, or the maple, is identical in its properties and composition when refined to the same pitch of purity, only that of the *beet* seems to *surpass* the other two in *cohesive force*, since larger and firmer crystals of it are obtained from a clarified solution of equal density.'

"'The most beautiful white sugar,' says Liebig, 'is now manufactured from the beet-root, in place of the treacle-like sugar, having the taste of the root, which was first obtained.'"

The present state of the law as to home-grown sugar stands thus:—The Act 1 Vic. c. 57, imposed a duty of 24*s.* per cwt. on unrefined Beet-root sugar grown in the United Kingdom; by 8 and 9 Vic. c. 13, the duty was reduced to 14s. per cwt.; and by 13 and 14 Vic. c. 67, the duty was further reduced to 10*s.* per cwt. from and after the 5th of July last, on all sugars grown and manufactured in the United Kingdom.

"Mr. MacGregor, in his 'Commercial Statistics,' makes the following statement on the manufacture of Beet-sugar in France—

'The number of establishments manufacturing Beet-root sugar, and the quantity produced in France during the following years, were— In 1828, fifty-eight establishments, producing 2,685,000 kilogrammes; in 1830, fifty-nine establishments, producing 6,000,000 of kilogrammes; in 1837 the number increased, under the protective system, to 543 at work, producing about 36,000,000 kilogrammes, while the average annual consumption for seven years of Beet-root and colonial sugars amounted to 95,335,554 kilogrammes. In 1838-9 there were 560 manufactories of Beet-root sugar, all, except five, actively at work, producing nearly 27,000,000 kilogrammes.' This shows an immense and steadily progressive increase from 1828 to 1837.

"In 1838-9, owing to the interference of the legislature, the trade received a violent but *temporary* check; for we find that in the following year it nearly doubles itself, far surpassing its culminating point in 1837.

"In the year 1850, the quantity of sugar produced was 75,000 tons, although in 1840 the duty was only 11*s.* 6*d.* per cwt., and in 1850 it amounted to from 18*s.* 7*d.* to £1 2*s.* per cwt. on raw sugars, according to quality, and £1 6*s.* 7*d.* on refined.

"The present year exhibits a still further increase of 10,000 tons for the year ending in April last!

"The Mincing-lane 'Commercial Daily List' of Wednesday, May 28, 1851, gives the following summary of the working of the Beet sugar manufactories in France during the past season:—

"In the 304 Beet-root sugar manufactories, in work at the end of last month, the total productious of the season, ending in April, amounted to 78,427,355 kilog., and the consumption for the same period was 62,248,430 kilog. The quantity remaining on hand at the end of the month was 16,209,255 kilog. During the corresponding period of the preceding year, the total production in the 288 manufactories then at work only amounted to 65,754,125 kilog., and the consumption to only 50,020,550 kilog.

"Thus, within the last year, the number of manufactories has increased by 16, or upwards of 5 per cent.; the total productions by 12,673,230 kilog., or upwards of 20 *per cent.;* and the consumption, by 1,227,880 kilog., or nearly 25 *per cent.!*

"The following extract as to the state of this manufacture in Belgium, is taken from one of the carefully written and deservedly autho-

ritative letters of the special correspondent of the *Morning Chronicle*, on the subject of Belgian Agriculture:—

"'The manufacture of sugar from Beet-root forms an important branch of Belgian industry. It is rapidly increasing; indeed, there is scarcely any department in which more activity is displayed. We have seen that in the year 1846 there were cultivated for this purpose upwards of 195,000,000 pounds weight of Beet-root; since that period the production has *enormously increased*, and the manufacture is carried on at a greater advantage than heretofore, because the leaves and refuse of the Beet-root, after the saccharine matter has been extracted, are used or sold for fattening of cattle. There is scarce a district where large sugar manufactures may not be found. Incomparably the best is that on the property of the Messrs. Claes, at Lembecq, where machinery of a novel and superior construction aids the manufacture to such an extent, that processes which formerly took six or eight days to perfect them, can now be accomplished in twenty-four hours.'

"Mr. M'Culloch, in his Commercial Dictionary (Ed. 1847), after observing that 'in 1842 it was resolved in France to raise annually the duty on beet-root sugar, by about five francs a cwt., till the duty on it should be equalized with the duty on colonial sugar—that this system came into operation on the 1st of August, 1844, and that in August, 1848, the equalization of the duties would be effected,' utters this gloomy prediction—'The probability is, that if fully carried out, this project will go far to annihilate the growth of beet-root sugar in France!' The theoretical *opinion* of the ablest political economist must yield to the superior force of *fact*. The manufacture, whose 'annihilation' was so confidently predicted, has flourished, notwithstanding the hostile enactments of the French Government. It is true the number of factories has decreased, but the capital invested has, since 1840, more than doubled, and the production is nearly 100 per cent. greater!—the natural result of competition between large manufacturers with ample resources, and men of smaller capital, who are more likely to be affected by fiscal alterations, and who cannot take advantage of improvements in machinery, &c. &c."

This prosperity, we are informed, shows at the present moment no signs of diminution, and the conclusion cannot be avoided, that this manufacture must be returning fair, if not liberal, profits on the capital invested in it. It may be argued that the colonial system of sugar manufacture is in a rude and imperfect state, and that the cost of colonial sugar will be reduced, just as that of wheat is in England at the present time by the operation of competition. This is true, but it is equally fair to assume, on the other hand, that the manufacture of beet-sugar is still in its infancy, and is open to the same improvement as that of the cane sugar. And, what is of as great importance, such a subject is infinitely more likely to receive in Europe scientific investigation, and the application of mechanical ingenuity, than it would be in the colonies. The cost of fuel in the colonies will always be a drawback against them. It will scarcely be believed, but we are told, upon the authority of an engineer lately returned from the West Indies, that it is only very lately that any attention has been paid to clothing the engines and boilers on the sugar estates, although, in many parts, coals are two pounds per ton, and the steam is almost universally used at high pressure. To save purchasing coals, the megass, or crushed cane, is commonly used for fuel, and thus the fields are robbed of the manure necessary to make them fertile. Rather than import coals, the planters import guano, and the megass-house often affords a tempting opportunity to the incendiary, or the no less fatal carelessness of the negro population.

The following fact is one of *degree* only, but is still of great importance, as showing that great improvement may yet be made in the growth of the beet:—

"One important practical discovery may be noticed here, which tends to enable the farmer to supply beet at a lower price, and should be taken into account in forming any estimate of the probable profits of the manufacture. We allude to the discovery by M. Peligot, that the root of the young beet is so much richer in saccharine juice than that of the mature plant, that if the roots be pulled up in summer, although the weight of the crop is much less, yet, as the quantity of sugar is larger, the value of the crop to the sugar manufacturer (after allowing for the loss in amount of pulpy residue) is in fact greater. Thus the ground becomes available much earlier for *other* agricultural operations, and the plants being pulled in a drier and steadier season, are much less liable to injury from exposure to the weather."

Mr. Seymour brings a strong array of figures to bear on the point of the economy of manufacture, and not without cause, for the illustrious Liebig (who is not, however, infallible,) has gravely stated that beet sugar "has no FUTURE,"—a polite German way, we suppose, of damning anything. Mr. Seymour, however, proceeds to show, that Liebig first states that from 6 to 12 per cent. of sugar is now obtainable from the beet, and in his estimates only allows 7½ per cent. He assumes that an acre of the "best land" in the environs of Magdeburgh produces only 6½ tons of beet, which may be true of that locality, but certainly cannot be applied to Ireland, where 15 tons of beet per acre is the ordinary produce of inferior land. On the other hand he estimates the yield of the cane at 40 to 50 cwt. of sugar per acre, although at another page he says that "it is quite inconceivable that the planters of the colonies should continue, as hitherto, out of the 20 per cent. of sugar in the cane juice, to lose 12 and to gain only 8 per cent.," or 16 cwt. only—a vast difference. Indeed, he appears to have taken the maximum sugar *in the cane*, without reference to what is obtained in practice, *out of it*. It appears impossible to reconcile these contradictory statements. Liebig points out a probable avenue to improvement in the following words:—"The discovery of a simple means of preventing the fermentation of the juice in hot climates, and, as a consequence, an increased return of sugar, even to the extent of only 4 per cent. would suffice to render the manufacture of beet sugar in Europe impossible, economically speaking."

Mr. Seymour has another opponent to grapple with, which he does with considerable energy. Professor Hancock, who, in a paper read before the British Association (page 215, *Artizan*, 1851) endeavours to prove the incompetency of the beet sugar manufacturer to struggle with colonial cane sugar. We give the professor's estimate.

"Would it be profitable to manufacture from beet-root, at the Irish price of 15*s*. 6*d*. per ton, refined sugar to sell at 28*s*. per cwt.? The calculations on this point which have been most relied on, are two in number—that of Mr. W. R. Sullivan, Chemist to the Museum of Irish Industry in Dublin, and that of M. Paul Hamoir, of the firm of Serret, Hamoir, Duquesne and Co., the largest manufacturers of beet-sugar at Valenciennes, dated 18th of April, 1850. These estimates are as follows:—

"MR. SULLIVAN'S ESTIMATE FOR IRELAND.

60,000 tons of beet, at 15*s*. per ton	... £45,000
Cost of manufacture, at 9*s*. per ton of beet	... 27,000
Total outlay ...	... 72,000
Produce, 5 per cent. of sugar, at 28*s*. per cwt.	... 93,000
Estimated profit ...	... £21,000

"M. PAUL HAMOIR'S ESTIMATE FOR FRANCE.

61,607 tons of beet, at 12*s*. 11*d*. per ton	... £38,400
Cost of manufacture, nearly 13*s*. per ton, of beet	... 39,900
Total outlay	... 78,300
Produce, 4½ per cent. of sugar, at 39*s*. per cwt.	... 114,000
Estimated profit in France	... £35,700

SAME ESTIMATE APPLIED TO IRELAND.

61,607 tons of beet, at 15*s.* 6*d.* per ton	£46,080
Cost of manufacture, nearly 13*s.* per ton of beet	39,900
Total outlay	85,980
Produce $4\frac{1}{2}$ per cent. of sugar, at 28*s.* per cwt.	81,430
Estimated loss in Ireland	£ 4,550

"'From these simple calculations,' adds the self-complacent Professor, 'it appears at once that by only introducing into the estimates the Irish and English prices of beet-root, and of refined beet sugar, the result is so varied as to turn a profit of £35,000 at the French prices, on a capital of £78,000 into a loss of £4,000 at the Irish prices!'

"First, as to Professor Sullivan's estimate:—This is quoted by Dr. Hancock, as if it was relied on, or even offered by him, as showing the probable profits attending the beet sugar manufacture. The fact being that it is an estimate *avowedly* made, to demonstrate that, even taking the least encouraging view of the manufacture; leaving out of the account all use whatever of improved processes, and taking the highest price at which the beet-root has been put by the most sceptical, its manufacture would give a handsome profit.

Does not Professor Sullivan repeatedly insist that beet must be growu cheaper in Ireland than in France, besides yielding a greater per centage of sugar? Does he not again and again assert that 6 per cent. is in his opinion too low? Nay; in the very page to which Dr. Hancock refers, does he not give an estimate at $5\frac{1}{2}$, 6, and $6\frac{1}{2}$ per cent. of sugar? Why then is the lowest estimate taken and the highest rejected? or why, the lowest being taken, is there no allusion to the existence of the former?

"Secondly, Dr. Hancock quotes 'the estimate of M. Paul Hamoir,' stating that he does so from Professor Sullivan's pamphlet; but on referring to the pamphlet, we find *five* estimates given, based on the calculations furnished by M. Paul Hamoir. The lowest being $4\frac{1}{2}$ (showing the yield obtained twenty years ago!) and then going on adding $\frac{1}{2}$ each time, till an estimate is given at $6\frac{1}{2}$ per cent.! The first shows a balance of £36,000; the second of £47,400; the third of £58,800; the fourth of £70,000; and the fifth of £81,600 from the 61,607 tons of beet! yet with these figures before his eyes, Dr. Hancock copies down the lowest calculations, and then brings them in this garbled shape before the British Association, as 'M. Paul Hamoir's estimate!'

"This fact alone is enough to deprive Dr. Hancock's argument of the slightest weight, and render both his facts and figures of very little consequence; but I cannot resist the pleasure of recording a little 'anecdote' here which will convey its own moral to the readers.

"It so happened that M. Duquesne, a member of the same firm in which M. Paul Hamoir is a partner (Messrs. Serret, Hamoir, Duquesne and Co.) was in London a few days after this 'estimate' of his partner had been given to the world by Dr. Hancock, and on his attention being called to the statements made before the British Association, he declared that 'the estimate' could not refer to his own house at Valenciennes, for the return of sugar obtained there was SEVEN PER CENT.

"Now I shall take the estimate in question, and 'apply it to Ireland,' to show Dr. Hancock that there are still 'two sides' even to the question he undertook to 'settle.'

"But before I do so,

1st. For beet at 15*s.* 6*d.* per ton read 10*s.* .... 7*s.*
2nd. For cost of manufacture at 13*s.* per ton .... read 10*s.* .. .. 9*s.*
3rd. For cost of desiccation at 4*s.* per ton ....read 1*s.* .... 8*d.*
4th. For $4\frac{1}{2}$ per cent. of sugar, read 7 per cent....... 8 per cent.
5th. For pulp, 10 per cent. at 9*s.* per ton ....read £2 .... £3

"I might add further '*errata*,' which probably the learned Professor may take notice of, should he ever, at the request of the British Association, publish a second edition of his paper on the beet sugar manufacture! Content with those I have stated, I shall now, in a tabular form, contrast the Doctor's calculations with my own, taking the figures most disadvantageous for my purpose.

DR. HANCOCK'S ESTIMATE.

61,607 tons of beet, at 15*s.* 6*d.*	£46,080
Cost of manufacture, nearly 13*s.* per ton	39,900
	85,980
Produce $4\frac{1}{2}$ per cent. of sugar, at 28*s.* per cwt. ...	81,430
Estimated loss in Ireland ..	£4,550

OUR ESTIMATE.

	£	*s.*	*d.*
61,607 tons of beet, at 10*s.*	30,803	10	0
Cost of manufacture, at 11*s.*	33,883	17	0
	64,687	7	0
Produce 7 per cent. of sugar, at 28*s.* per cwt.	136,767	10	9
Estimated profit	72,080	3	9

"Thus a 'loss' of more than £4,000 becomes a gain of more than cent. per cent.!"

(To be continued.)

COTTON AND ITS MANUFACTURING MECHANISM.

BY ROBERT SCOTT BURN, M.E., MEM. S.A.

(Continued from page 26.)

THE annexed diagram will illustrate the arrangement of Calvert's cotton-gin. *b* is the central drum, furnished with serrated steel blades; a fluted roller, *a*, revolves in the same direction as *b;* the fibres of cotton are taken from the central drum by the revolving brush, *c*, the speed of which is somewhat greater than that of *b; e* is a fixed plate, the lower edge of which is very nearly in contact with the fluted roller, *a;* another plate, *d*, is moveable, and can be adjusted to within any desired distance of the circumference of the central drum, *b*. The hopper into which the cotton to be ginned is placed, is formed by the two plates, and by the sides of the machine. On the hopper being supplied, and the moving power applied, the seeds and cotton derive motion from the revolution of the fluted roller, *a*, and the drum, *b;*

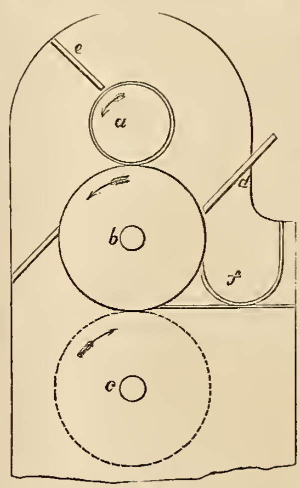


Fig. 1.

the serrated blades of the latter partially combing out the cotton from the lowermost seeds; the seeds thus acquiring a circular motion, are subjected completely to the action of the blades, and the cotton combed out; the seeds pass through the opening left betweeu the end of the adjustable plate, *a*, and the circumference of the drum, *b*. The cotton is supplied to the hopper from time to time; a certaiu quautity only being subjected to the combing action of the drum, *b*, at a time. The revolving brush, *c*, strips the cotton from *b*, and delivers it to a suitable receiver, or it may be delivered to a creeper, and finally wound upon a roller.

For the convenience of transport, the cotton, after being ginned, is

compressed into bags by hydraulic presses; this operation causes the cotton to become matted, and the fibres entangled with one another; sand, and other extraneous matter, is also frequently pressed up with the cotton. On arrival at the factory in which the material is to be worked up into yarn, or woven into cloth, the bags are opened, and the operation of "mixing," before alluded to, is gone through. The fibres are next subjected to the action of the first factory machine, termed the "willow," or "devil," as it was formerly called, probably from its rough operation. The action of the willow is to open the fibres, and disentangle them. This was formerly done by "butting;" the cotton was placed on an elastic horizontal network of cords, and repeatedly beat with slender rods or wands; the impurities falling through the meshes of the net to a receptacle below. In India, a large bow is used for opening the fibres of cotton; "it is made elastic by a complication of strings; this being put in contact with a heap of cotton, the workmen strike the string with a heavy wooden mallet, and its vibrations open the knots of the cotton, shake from it the dust and dirt, and raise it to a downy fleece." In America, cotton was formerly opened by means of the bow; hence the origin of the term so often seen in cotton price lists, "bowed cotton." With the exception of fine-spinning establishments, where high-numbered yarn is produced, the operation of butting has been entirely superseded by the willow. The improved form of machine now generally used is that known as the conical "willow." The principle of its arrangement and operation will be understood from the following diagram and description:—

The conical drum, *c c*, fig. 2, revolves rapidly on a horizontal axis (shown by the dotted lines), within a case, *d d*, *f f*. The surface of the cone is provided with a set of projecting teeth or spikes, the upper

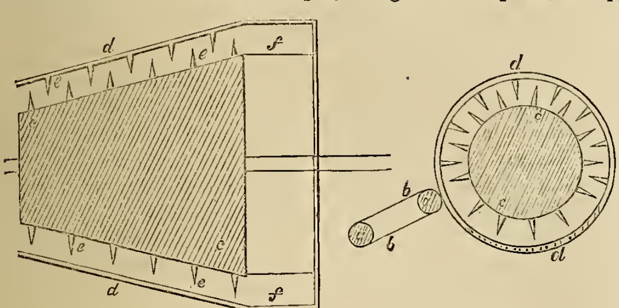


Fig. 2.

side of the inner surface of the case being furnished in a similar manner; the teeth of the cone moving in the alternate spaces between those of the case. The machine is fed at the smaller diameter of the cone, by means of an endless apron, *b b*, passing round two rollers, *a a*; this apron is made of thin spars of wood about three quarters of an inch round, and fixed to two endless leather straps, which pass round the rollers, *a a*; interstices are left between each spar forming the apron, it thus easily passes over the circumference of the rollers. The cotton, fed to this apron by hand, is slowly introduced to the small end of the revolving cone, it is immediately seized by the projecting teeth, and whirled rapidly round; as the cotton passes along the surface of the cone, its speed is increased, in consequence of the enlargement of the diameter; it is finally delivered to the larger end at *f f*, and passed on to a moving apron, or deposited on the floor. The fibres being torn open by the action of the spikes, the dirt, twigs, &c., &c., are set free, and their heavy portions fall down through the grating, which forms the under side of the case; while the lighter dust is carried off to ventiducts communicating with the external air, a sufficient current for this purpose being created by the rapid revolution of the cone.

(To be continued.)

NOTES ON DESIGNING MACHINERY.

A Correspondent some time since put the simple question to us, "What do you consider the best form of stationary engine for agricultural purposes?" to which question there is only one answer, and that a very unsatisfactory one: "It depends upon circumstances.' Even leaving out the mercantile part of the question, which materially simplifies it, the abstract mechanical one is strangely perverted by many who possess practical knowledge, but who are ignorant of what is going on beyond their own sphere. Purchasers may rely upon it, that there is much less difference in working, between the engines of *really good makers*, than they are apt to imagine. When a new firm commence making engines, if they select their designs with judgment, and get self-acting tools to suit, they at once lower the price to the public, and every other maker within the influence of their competition have to come down to their prices. At length, some one, exasperated at his diminished profits, boldly throws aside his old notions and tools, makes a fresh start and takes the lead, to be supplanted in his turn by another. Thus we find that the prices amongst respectable makers differ but little, whilst the forms of their engines assume every variety that fancy can suggest.

We have a plate lying before us of a pair of steeple engines, constructed for the United States' mint, by Messrs. J. P. Morris and Co., of Philadelphia, from the designs under the superintendence of Mr. Franklin Peale, Chief Coiner, a notice of which may be interesting. The following description of them is given in the *Franklin Journal*:—

The general design of this engine conforms to the Gothic, or pointed style, and its construction is what is commonly known as the steeple engine, working by simple high pressure; there are, however, peculiarities, and as far as is known to us, novelties in construction, which it is thought are entitled to attention.

It is a combined or double engine, with the cranks at right angles, and has no fly-wheel, properly so called, but a pulley or drum, from which the power is carried off by a broad belt, two feet in width. The drum is cast hollow, with chambers in the periphery, into which lead has been run, to counterpoise exactly the pistons, triangles, pitmen, &c., so that the engine is in perfect equilibrium in every position, and performs its revolutions in an equal and regular manner.

It will be observed, also, that it is perfectly symmetrical in all views, and that there are no steam or exhaust pipes visible on the exterior. A heavy bed plate, serving as a base, of twelve inches elevation, supports the frame and cylinders; it rests upon a brick foundation laid in cement, and secured by strong bolts built in. The steam passages have been cast in the bed plate, to convey the steam to and from the chests and cylinders, which stand vertically upon it. The pipes which convey the steam from the boilers to the engine are placed in a passage or chamber built in the foundation, in which chamber the throttle valve, controlled by the governor, is placed.

The cylinders (15 inches diameter × 4 feet stroke) are placed eccentrically, within cylindrical cases, forming *jackets*, the intervening space being the steam chest, containing the valve seats and long slide valves, moved by the eccentrics, which are placed upon the shaft, immediately above; the eccentric position of the outer cylinder or jacket, allowing the required space on one side for the valve, and a sufficient space all round, for the channels and steam.

The cylinders are fitted over one another with conical metallic joints, and the cylinder covers contain the stuffing boxes of the piston and valve rods.

It is this position and arrangement of double eccentric cylinders, giving space for the valves, channels, and steam, and forming a jacket round the working cylinders, which is claimed as an economic novelty, simple in its form, easy of construction, and presenting on the exterior a plain bright surface, an important security from loss of heat by radiation, or condensation of steam in the interior; and, finally, entirely divested of the usual disfiguring appendages of steam channels, pipes, joints, &c.

The piston rods and guides are made of steel; the cross-heads travel upon the latter, with metallic packing of an approved alloy, with tightening screws.

The pistons are furnished with what is termed steam packing—in other words, metallic plates, held against the surface of the cylinders by the pressure of the steam.

The triangles or stirrups connected in the centre of the bow with the piston rods, are forged in one piece, and are planed up, and finished bright throughout.

A simple solid pitman (connecting rod) forms the connexion with the cranks, a double stub-end (butt-end) and strap connecting with the cross-head above, and a single one below, working on the wrist (crank) pin.

The shaft and drum are supported on two cast-iron frames, which conform in general features to a pointed arch window, strengthened by pannels, and enriched by columns, supporting the pedestals, and carried up to a finial, its exterior being decorated with appropriate crockets. The two frames are connected above the drum by stays and braces, which are consistent with the style, so arranged as to afford space, within which the governor stands, centrally and appropriately, to regulate the motion of all that is below and around it.

The engine is moved by steam at a pressure of eighty pounds, and is intended to be run at fifty revolutions per minute; this rate of motion is maintained without the slightest vibration, jar, or noise, and is calculated to give a sufficient effective force for all the heavy operations of the mint. The power is applied, through the agency of belts, to the rolls, and other machinery, silently but efficiently, an evidence that in mechanics, as in moral science, the best effects may be produced with the least noise.

The writer of the foregoing description has said nothing to which we can take exception, as the neatness of the design is unexceptionable; but he has left unsaid many things which would, we fear, detract somewhat from the credit due to the designer. Elegance is doubtless a desideratum; but the designer who should sacrifice any portion of efficiency, merely to please the eye, cannot in our opinion be commended for his judgment. "What is best, looks best," is a maxim we would impress upon all designers of machinery. If you cannot make a good thing a neat thing, depend upon it, it is your own fault, and the remedy must be sought in patient study, if the object be worthy of it. In the case before us, the inner cylinder is a complicated casting, and is fitted into the outer one "with conical metallic joints"—a method which is both expensive and hazardous; should any leakage occur from the unequal expansion of the cylinders, it would neither be readily discovered nor stopped. We do not see any means of getting at the cylinder faces to fresh-surface them when required, without taking the cylinders asunder. Any saving anticipated from the use of a steam jacket, is, in practice, so small, that it will not pay for the increased expense; a sufficiently good result is obtained by a felt and wood casing. The slides are two short ones, connected together by a bar. No provision is made for working expansively, and no feed pumps, nor means of working them are shown. Otherwise than the points we have mentioned, there is but little of novelty to notice.

We are not aware of the price of fuel in the locality where the mint is situated, but it appears to us that in a public establishment, where capital is not wanting, economy would have been better consulted by making a double cylinder condensing engine. The same arrangement might have been preserved, and a condensing engine substituted for one of the high pressure ones. The cranks would then be placed opposite each other, instead of at right angles, and the fly-wheel might be placed on the second motion.

We do not think that the best arrangement has yet been hit upon for steeple engines. The crank shaft is too far from the sole plate, and the engine is generally top-heavy. By sinking the cylinder into the sole plate, the height of the engine would be materially diminished; the slide face should be placed outside of the cylinder to render it easy of access—a point which cannot be too strongly insisted upon.

In this country, the only cases that we are aware of, of this form of engine being used for large powers on land, are in the fen districts, where they have been applied by the Butterley Company and other firms to scoop wheels for drainage purposes. In these instances, the crank shaft is carried by a strong entablature running across the engine house, built into the wall at either end, and also supported by two columns standing on the cylinder sole plate. This obviates the objection of unsteadiness which we have noticed above, but is subject to the evil of being dependent on three points, which may settle unequally, and entail a vast amount of trouble and expense on the engine-maker, if his contract includes the upholding of the work.

SOCIETIES.

INSTITUTION OF MECHANICAL ENGINEERS.

"*On an* Improved Boiler for Marine Engines," by Mr. Andrew Lamb, of Southampton.

The Peninsular and Oriental steam ship *Ripon* is an iron vessel, of 1650 tons burthen, and has two oscillating engines, of 450 nominal horse power. She was built by Messrs. Wigram in 1846, and was supplied with her machinery by Miller, Ravenhill, and Co., of London, since which time she has been almost constantly running for the conveyance of the Indian Mail from Southampton to Alexandria.

Her average speed for the whole of this time has been 9.1 knots per hour. The boilers fitted to her by Messrs. Miller were of the ordinary tubular construction. They were in six pieces, had twelve furnaces, and 744 iron tubes, $3\frac{1}{4}$ inches outside diameter, 6 feet 6 inches long. The total fire-bar surface was 212 square feet, and the heating surface in tubes 3,798 square feet, reckoning the whole of the inside surface of the tubes as effective.

The sectional area through tubes equals $36\frac{1}{2}$ square feet; ditto through ferules, 28 square feet. These boilers were loaded to 10 lbs. on the square inch, but in consequence of being deficient in steam, the actual pressure attained at sea very seldom exceeded 4 to 6 lbs. when full steam was admitted to the cylinders; of course the engineers found it to their advantage to keep it up to its full pressure by working the expansion apparatus. This deficiency of steam was found to be an increasing evil, the cause for which may be satisfactorily explained by a little consideration of the *modus operandi* of the sea-going tubular boiler. When commencing running with the boilers new, for a short period, dependent on the species of coal consumed, the tubular boiler offers its greatest advantage, and is, in fact (when properly constructed), as good an apparatus for evaporating water as can be imagined applicable to marine purposes. The tubes give an immense amount of heating surface, and in small compass, and from their form are capable of resisting great pressure, but after three or four days' steaming, these advantages diminish. The tubes have an accumulation of soot and light ashes inside them, which, by reducing their sectional area, sometimes from 50 to 75 per cent., diminishes the draught through the furnaces in the same proportion, and also reduces the effective heating surface to the same serious extent. This accumulation depends in quantity very much upon the coal. On one occasion the author was present in a vessel with tubular boilers, burning Scotch coal, and they actually came to a dead stand, after only sixty hours' steaming, the tubes being nearly choked up, and requiring to be swept. When tubular boilers have made a few voyages at sea, the outside of the tubes becomes encrusted with saline matter, which gradually accumulates upon them, chiefly upon their bottom sides, and which hitherto it has been found impossible to remove by any other means than scaling them mechanically. The situation of the tubes (row over row) prevents this being accomplished, excepting upon the upper tiers, and the consequences are, that the tubes become coated with a crust $\frac{1}{4}$ or $\frac{3}{8}$ths of an inch thick, and the tube-plates also, which from its non-conducting nature greatly retards the trans-

mission of the heat through it, and the tube plates becoming hot, crack and blister, and deteriorate very rapidly.

For the boiler to be described in the present paper, invented and patented by the author in conjunction with Mr. Summers, the following advantages are claimed over its tubular competitor:—

1st.—That, while it possesses an equal amount of heating surface in the same space as tubular boilers, it is free from the evil of choking with inside deposits of soot and ashes, because the flues being in one sheet for their whole depth, the deposit falls into the bottom of the flues, and is swept by the draught through into the up-take, and thence into the chimney.

The flues are flat rectangular chambers, 6 feet 9 inches long, and 3 feet 3 inches high, open at each end, where they are fixed to the boiler. There are seven of these flues to each fire-grate; the smoke spaces are $1\frac{3}{4}$ inches wide, and the water spaces $2\frac{5}{8}$ inches. The sides of the flues are $\frac{1}{4}$ inch thick, and they are supported by stays, fixed inside the flues. From this circumstance of there being no stays or other projections in the water spaces, an important advantage is gained—that no nucleus is offered round which the scale can collect, and no impediment to interfere with the complete and rapid cleansing of the water spaces from scale by means of the ordinary scrapers.

In another arrangement of these boilers, adapted for large screw steamers, and also for war steamers, the flues are placed alongside the furnaces and at the same level, instead of over the furnaces, as in the engravings, which arrangement protects the boilers from shot, by keeping them below the water line.

In these improved boilers, the same amount of heating surface can be obtained in the same capacity of boiler as with tubes; the only difference is, that if the tubes are $\frac{3}{10}$ths of an inch thick, they will of course be rather lighter than $\frac{1}{4}$-inch plates; but this difference, as compared with the gross weight, is so small as to be unimportant. In the event of any accident to any of the flues, they may be taken out, separately or collectively, to be repaired or replaced with new ones; but from the facility with which they can be kept clean, they ought, as in the old-fashioned flue boilers, to wear out the shell; the length of time being remarkable that a *thin* plate will last, if kept clean, and never overheated.

The last boilers of this construction examined by the author were those of the *Tagus*, 280 horse power, and in those boilers, after six days' steaming, the deposit was only three inches deep in the bottom of each flue; and the total depth of the flues being 3 feet 8 inches, it follows that she had only thus lost about 6 per cent. of sectional area.

2nd.—That the improved flues, from having no projection either of rivet heads or stays in the water spaces, offer no obstructions whatever to the scaling tool, and are as easily kept clean as any part of any boiler can possibly be, thereby entirely removing the evil of a loss of heat through non-conducting deposits, and very much increasing the durability of the boiler.

3rd.—That the water spaces between the flues being comparatively large, and the sides of the flues perfectly vertical, the circulation of water in the boiler must necessarily be much more perfect than amongst a number of tubes (amounting sometimes to thousands), where the water has to wend its way in and out in curved lines. This greater perfection of circulation, the author thinks, must add greatly to the effectiveness of the heating surface in the improved flues.

It must be here mentioned, that these advantages do not now rest upon theory only, and that they have been fully realized by experience.

The first boilers fitted with these flues were those in the *Pacha*, in October, 1849, similar to those shown in the engravings, and up to the time of her unfortunate loss, these boilers gave entire satisfaction. Then followed a small boat, in January, 1850, and the *Tagus*, in August, 1850, since which their success has been rapid, as a proof of which, numerous vessels of different Companies are being and have been fitted with them. The *Tagus* has now the oldest of the boilers, and there is in no part of them any signs of deterioration whatever; in fact, they are in every way perfect. There has never been any leakage, and the consumption of fuel is less than with her former tubular boilers.

The improved boilers now fitted to the *Ripon* were manufactured by Messrs. Summers, Day, and Baldock, of Southampton, and are in four parts, the boilers being placed in the wings, two forward of the engines, and two aft, the stoke-holes are thus in midships.

The space occupied by these new boilers is the same as the old ones, the arrangement mentioned having economised as much room as the increased size of boilers required, so that the same quantity of coal is carried in the same space as before. The n w boilers have 16 furnaces and 246 square feet of fire-bar surface; 112 flues, 3 feet 9 inches deep $\times$ 6 feet 3 inches long, being 5,440 square feet of heating surface, reckoning the whole inside surface (as in tubes); the sectional area through the flues, deducting the stays $=$ 54 square feet.

This large sectional area can be diminished at pleasure by a grating damper, which is hung at the front end of the flues, and extends about 10 or 12 inches down them, and which is worked by handles placed outside the boiler and between the hinges of the smoke-box doors. The engineer can thus regulate the intensity of his draught at pleasure, according to the variety of coal in use, &c., &c.

The new boilers of the *Ripon* are loaded to 13 lbs per square inch; the flues being strongly stayed inside, would of course resist a far higher pressure with perfect safety; in fact, if required, they might easily be sufficiently stayed to resist steam of any pressure.

The *Ripon*, at the same time that the boilers were altered, had her common radial paddle-wheels replaced by feathering ones, which consequently added much to the speed of the vessel.

The best speed of the engines of the *Ripon*, with the old arrangement, was about 15 revolutions per minute, and that of the vessel about 10 knots per hour, when quite light.

On the trial at the measured mile, December, 1851, the vessel was drawing 16 feet 3 inches forward, and 16 feet 7 inches aft; she had all her coal (422 tons) on board, her water, and some cargo, and consequently was pretty deep loaded. The speed of the engines was $19\frac{1}{2}$ revolutions per minute, and of the vessel 11.3 knots per hour. Had she been light, as in the former trial, she would have probably gone over 12 knots. It appears, therefore, that the improvement in speed may be fairly stated as two knots per hour, .The cylinders of the engines are 76 inches diameter $\times$ 7 feet stroke. Their nominal horse power formerly, at 15 revolutions, would be 404, and at $19\frac{1}{2}$ revolutions, 526 horse power, so that the new boilers have given 122 horse power more steam, of an increased pressure of 3 lbs. per square inch, than the old ones. As the *Ripon* is now making her first voyage with the new boilers, the author cannot speak with any certainty about her consumption, but will give some details of the Peninsular and Oriental steam ship, *Bentinck*, which has made one voyage to Alexandria and back, with these improved boilers and feathering wheels.

The *Bentinck* is a wooden vessel, built by Wilson, of Liverpool, in 1844, and has side lever engines, by Fawcett and Preston. She is 2,020 tons burthen, and her engines are 520 nominal horse power; her original boilers were of the old flue construction, and were loaded to 6 lbs. per inch pressure; her average speed at sea was 9 knots per hour, and her engines about 14 revolutions per minute.

The speed of the *Bentinck* is now over 11 knots per hour. The former consumption was about 37 cwt. per hour; the present consumption averages about 38 cwt. per hour.

It must be noticed that the Peninsular and Oriental Company had tubular boilers, with brass tubes, made for this vessel by Messrs.

Bury, Curtis, and Kennedy, and that they were brought to Southampton, and placed in the *Pottinger*, a sister ship of the *Ripon*, and of 450 nominal horse power, with common paddle-wheels; these boilers are of exactly the same size as the patent boilers made for the *Bentinck*, and they are both loaded to the same pressure, viz., 12 lbs. per square inch; they have each made a passage to Alexandria and back, and, contrary to all expectation, the *Bentinck*, although her engines are 70 horse power nominal more than the *Pottinger*, and are working up to 103 horse power more, has consumed 128 tons less coal than the *Pottinger*, and performed the same distance in $68\frac{1}{4}$ hours less time. This result of diminished consumption is undeniably a fair triumph for the improved boiler; as for the improved speed of the vessel, it must share the honours with the feathering paddle-wheel; the *Bentinck* has made the fastest passage on record between the ports mentioned.

In conclusion, the author can only say, that he believes the improved boiler, described in the present paper, will become the marine boiler generally adopted; as its merits are evident, and its cost is not greater than tubular boilers; while its durability will, he thinks, be very much greater. He will be happy to show these boilers to any of the members of the institution who may have an opportunity of seeing those that may be in port, or at Mr. Summers' works at Southampton, where there are now five sets in course of construction. It may be added, that the screw steam ship, *Glasgow*, by Messrs. Todd and McGregor, which has lately made the fastest run across the Atlantic of any screw steamer, is fitted with these improved boilers; Messrs. Todd and McGregor have made a considerable number of them, and they are also being manufactured by several others. It is intended also to adopt these boilers in the *Himalayah*, now building for the Peninsular and Oriental Co., of upwards of 3,000 tons burthen, to be propelled by oscillating engines of 1,200 horse-power.

Fig. 1.

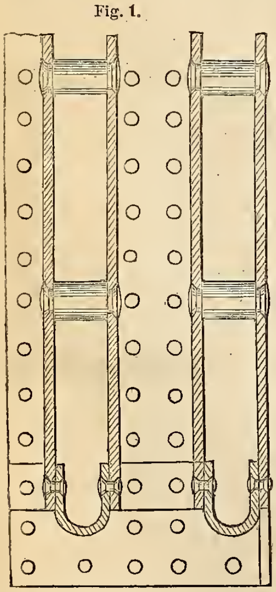
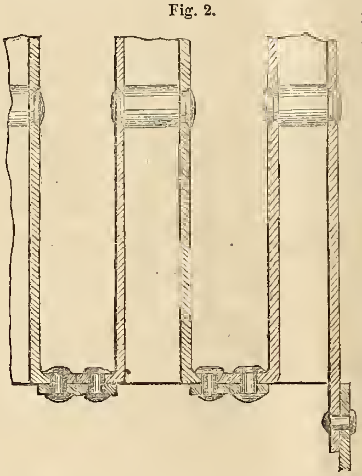


Fig. 2.



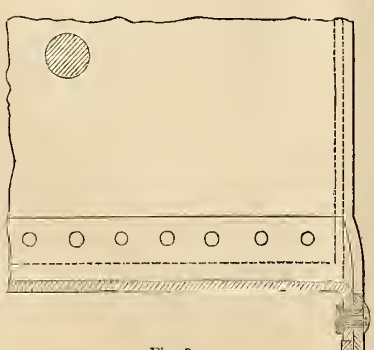


Fig. 3.
(Scale, one sixth size.)

[Note.—The details of construction of the flues are shown in figs. 1, 2, and 3; fig. 1 is a transverse section, fig. 2 a plan, and fig. 3 a longitudinal section of a portion of the flues shown on an enlarged scale. They are constructed of two flat side plates, $\frac{1}{4}$ inch thick, flanged outwards at each end to meet the plates of the adjoining flues; the top and bottom of each flue is formed by the curved connecting piece, which is rivetted to each side plate, and flanged outwards at the ends. The stays or studs, are $1\frac{1}{8}$ inch diameter, and are rivetted at each end through the side plates. The rivets connecting the plates together, and the stays, are all put into their holes simultaneously, and rivetted cold by machinery. These rivets have countersunk heads and points, and when placed in their holes in the plates, a steel bar is inserted, which fills up the space between the heads of the two rows of rivets, and acts as a bolster to the riveting tool. By this means, one stroke of the machine closes two rivets at once, and in the most efficient manner. The flues are afterwards rivetted together with covering strips, at their ends, and they are inserted into the boiler in sets of seven or eight, according to the size of the furnace.

Any one of the flues can be readily extracted from the others if necessary, by cutting away the two rows of rivets each end, and drawing it out through the front smoke-box doors. The experience which they have had of the durability of the flues has, however, satisfied those who have employed them, that unless gross negligence of the engineer should (through want of water) allow them to get red hot, the flues will in all cases outlive the shells in which they are inserted. Drawings of the Boilers will be found in the *Artizan* for December, 1850.

The Chairman observed, that he regretted Mr. Lamb was not able to be present on that occasion, to have given them further practical information on the construction of the boiler that was desirable. He had not explained in the paper the mode of fixing the flue-plates to the boiler at each end, and the mode of removing and replacing the flues when required.

Mr. Shanks said, he had seen some of the boilers on that plan making at Glasgow, but was not acquainted with the practical details.

Mr. E. Jones thought there would be some practical difficulty in removing and replacing the flue-plates without disturbing the boiler.

The Chairman remarked, that the question of principle in the boiler was one of heating surface, and there was certainly a considerable advantage in having only the small horizontal surface at the bottom of the flues for the deposit to collect upon, and the vertical position of the plates allowed the freest fall for the deposit to the bottom.

Mr. Cowper said, the construction of the boiler reminded him of Hancock's boiler, which was invented for common road locomotives; that boiler consisted of a number of very thin flat chambers, with a number of stays passing through all the chambers, which were in tension instead of compression, as in Mr. Lamb's boiler; these stays passed through a series of ferules, or very short tubes, forming struts both inside the chambers and between them. The boiler was very complicated, from having so great a number of joints, and was consequently very troublesome to keep steam-tight; but it was a very effective plan for generating steam, and very economical of space; the air came away from the flues as cool as in a locomotive chimney. A short narrow flue is equal to a long wide flue, as in the large flue boilers, for extracting the heat out of the air passing through it, as the whole of the air is brought so much sooner in contact with the sides of the flue.

Mr. Middleton said that the boiler described in the paper reminded him of another boiler somewhat similar to Hancock's, where there was great difficulty in keeping it steam-tight. The bottom of the flues was not considered so good a heating surface as the top of the flues, and therefore in Mr. Lamb's boiler the whole of the sides of the flues should not be calculated as efficient heating surface; he thought two thirds would be enough to take.

Mr. Cowper observed, that would be merely a question of what value was put upon the heating surface per square foot. But there would be more loss from that cause in tubes than in Lamb's flues, as the bottom surface of each tube amounted to a fourth or more of the whole heating surface; but in Lamb's boiler the bottom surface of the whole flue was only equal to the bottom of one tube.

The Chairman considered it desirable to obtain further particulars from Mr. Lamb respecting the boiler and its relative evaporating efficiency as compared with the ordinary tubular boiler.

Mr. Shanks said that Messrs. Todd and McGregor had last year

built for the Peninsular and Oriental Co. two vessels exactly the same in every respect, except that one had tubular boilers and the other Lamb's flue boilers; they were both, he believed, performing their voyages in the Indian Ocean; and they would supply an excellent means of making a comparison between the two constructions of boilers, and he hoped Mr. Lamb would report the results of this trial to the Institution.

Mr. Allan suggested that the flues might be put in with a flange all round at each end, like the mid-feather in a locomotive firebox, and fixed by two rows of rivets down each water space. The rivet heads might then be readily cut off all round any one flue, and the flue taken out when required; and a new flue might then be inserted, by reaching down the water spaces between the flues to put the rivets in.

Mr. Cowper observed, that he had once been told by Mr. Preston, of Liverpool, of a tubular boiler of ordinary construction in a steamer on the Mersey, which did not make steam enough, and he found on examination that the tubes were all set solid together with the deposit formed between them, so much so, that he cut off all the tubes at each end inside the tube-plates, and took them all out in one mass.

Mr. Shanks said he remembered the boilers of the *Caledonia* steamer, after seven years' work across the Atlantic, were found to be still in good condition, and with very little scale upon them; they were common flue boilers, and were kept clean chiefly by the constant use of the brine pump. He inquired whether, in stationary boilers, Ritterbandt's plan of using muriate of ammonia did not prevent incrustation?

The chairman observed, that Ritterbandt's process only removed the carbonate of lime, but did not act on the sulphate, which formed a large portion of the deposit.

Mr. Cowper said he remembered trying that plan in a pair of stationary engine boilers, but after finding that it caused the engines to get quite rusted, the plan was abandoned.

The Chairman proposed that the discussion on the boiler should be adjourned, and Mr. Lamb be requested to give them the further information respecting it at the next meeting; he proposed a vote of thanks to Mr. Lamb for his communication, which was passed.

"*On a* Continuous Expansion Steam Engine," by Mr. James Samuel, of London.

The economy of working steam expansively is well known, but the application of the expansion principle is practicable only to a limited extent in most forms of engine, from practical difficulties in their mode of working, which prevent the attainment of the full economy of which the expansive principle is capable.

The greatest useful effect is obtained from the steam, when it is allowed to expand in the cylinder until its pressure upon the piston just balances all the useless resistances of the friction of the engine itself, and the resisting pressure on the back of the piston (whether the pressure of the atmosphere, in a high-pressure engine, or of the uncondensed vapour, in a condensing engine), the surplus power beyond these useless resistances being alone available for the purposes to which the engine is applied.

But in driving machinery, so great a uniformity of motion is essential, that any great variation in the moving power throughout the stroke of the engine is inadmissible, as the fly-wheel would not be able to absorb enough of the excess of power to equalise the velocity sufficiently, by giving it out again at the deficient part of the stroke; consequently, though two engines are often employed working at right angles to each other, for the purpose of diminishing the variation in total moving power, the expansion principle can only be carried to a portion of the extent to which it is theoretically applicable.

Only in such engines as the large Cornish pumping engines can the expansion be carried practically to its full theoretical limit, as the variation in the velocity of the load moved is of much less importance in those engines, and the very unequal amounts of moving power that are developed in equal times, by the full carrying out of the expansive principle, which would produce the most prejudicial and inadmissible variations of velocity in the engine, are controlled within prescribed limits by the great weight of material to be moved by the engine in the pump rods and balancing machinery, forming, as it were, a distributing reservoir for the moving force developed.

In the locomotive engine there are practical difficulties in carrying out the expansion principle efficiently, beyond a moderate extent, in a single cylinder, from the shortness of stroke, and rapidity of reciprocation, and the construction of the valve motion; but the ultimate extent to which it could be carried would be limited by the maintenance of the blast, which requires that the jets of steam discharged from the cylinder into the blast-pipe, should not be reduced below a certain pressure at the moment of discharge. Otherwise, the limit to which expansion might be carried would be the resistance of the atmosphere to the discharge of the steam, added to the friction of the engine, say above 10lbs. per inch above the atmosphere.

The steam is cut off usually by the link motion at from $\frac{1}{3}$rd to $\frac{2}{3}$rds of the stroke, and the steam is consequently discharged into the blast-pipe at about from 30 to 60lbs pressure above the atmosphere, sup-

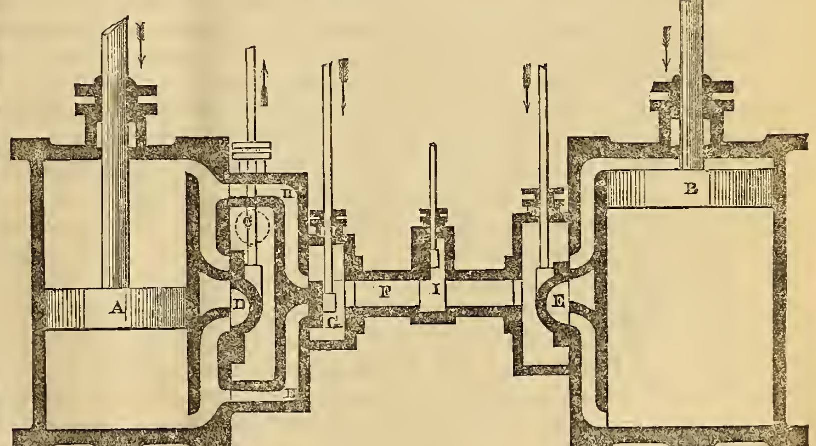


Fig. 1.

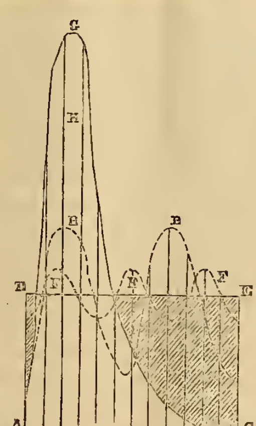


Fig. 3.

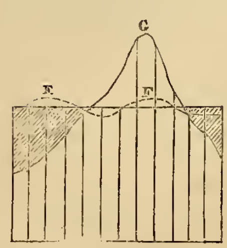


Fig. 4.

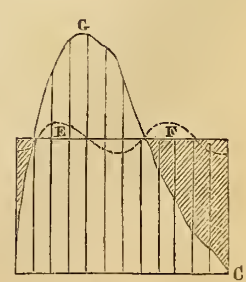


Fig. 5.

posing it to be supplied to the cylinders at 100lbs. per inch above the atmosphere.

It appears that the lower of these pressures is sufficient, or more than sufficient for the purposes of the blast, to maintain fully the evaporative power of the boiler under general circumstances, and that a portion of the steam discharged can be spared from the blast, to be subjected to a greater extent of expansion.

In the continuous expansion engine, the subject of the present paper, the steam from the boiler is supplied only to one cylinder: a portion of it is expanded into the second cylinder, which is of proportionately larger area, so as to equalise the total moving power of the two cylinders; and it is there further expanded down to the fullest useful extent, and then discharged into the atmosphere, the portion of steam remaining in the first cylinder being discharged as a blast at nearly the same pressure as the ordinary engines. The economy, therefore, consists in obtaining from such portion of the steam as can be spared from the blast, the additional power of expansion remaining in it, which is thrown away in the ordinary engine.

Fig 1 shows the continuous expansion engine, as applied to a locomotive. A is the first cylinder into which the steam is admitted from the steam-pipe, C, by the valve, D, in the same manner as in the ordinary engines. The steam is cut off at half stroke, and a communication is then opened with a second cylinder, B, through the passages, H and F, by the opening of the slide valve, G. The second cylinder, B, is about double the area of the first cylinder, and the same length of stroke, but the cranks are set at right angles, as in ordinary locomotives; consequently, at the moment of the steam being passed into the second cylinder from the first, the piston of the second cylinder is at the commencement of its stroke.

The steam continues expanding in the two cylinders, until the first piston, A, has nearly completed its stroke, when the valve, G, shuts off the communication between the two cylinders, and the valve, D, opens the exhaust port, and communicates with the blast-pipe, L, discharging the steam remaining in the cylinder, A, to form the blast in the ordinary manner. The second piston, B, has then arrived nearly at half stroke, and contains nearly one-half of the total quantity of steam originally admitted to the first cylinder; this steam is further expanded to the end of the stroke, and then discharged into the blast-pipe, L, by the valve, E, opening the exhaust port.

The return stroke of both pistons is exactly similar to the foregoing, so that about $\frac{1}{2}$ cylinder full of high-pressure steam (or such other portion as may be desired) is supplied to the first cylinder at each stroke, and between $\frac{1}{2}$ and $\frac{2}{3}$rds of that steam is discharged at the pressure required to produce the blast, and the remainder of the steam is expanded down in the second cylinder, so as to give out all the available power remaining in it.

For the purpose of enabling the engine to exert an increased power, if required, at the time of starting a train or otherwise, the slide valve, I, is inserted in the centre passage, F, to close the communication between the two cylinders for a short time when required; and the steam from the boiler is then admitted by a pipe and cock into the steam-chest of the second cylinder, B, which is then worked independently of the other cylinder, like an ordinary engine.

The comparative quantity of steam or of coke required to perform the same work in the several engines, under the circumstances stated above, is given by calculation as follows :—

Continuous expansion engine			.. .. ..	100
Ordinary engine, cutting off at		$\frac{1}{3}$rd stroke	..	120
Ditto	ditto,	ditto $\frac{1}{2}$ stroke	..	154
Ditto	ditto,	ditto $\frac{2}{3}$rds stroke	..	185
Ditto	ditto,	ditto $\frac{7}{8}$ths stroke	..	220

These figures represent the relative economy in the employment of the steam in the several engines; consequently, the ordinary engine, with the best degree of expansion, or cutting off the steam at $\frac{1}{3}$rd of the stroke, consumes 20 per cent. more coke than the continuous expansion engine, to do the same work, and from 54 to 85 per cent. more coke with the more usual degrees of expansion; and an engine cutting off the steam at only $\frac{1}{8}$th of the stroke from the termination, as many engines were formerly made, would consume 120 per cent. more coke to do the same work.

This plan has been tried upon two locomotives with satisfactory results, and the blast was found to be quite sufficient; but the trial has not been sufficiently complete to afford a definite comparison of consumption.

In the application of the expansion principle to stationary engines, it is requisite to consider the amount of variation in the moving power or labouring force of the engine, and the limits within which it is necessary practically to confine this variation. The accompanying diagrams show the variation in the moving power that takes place between the commencement and the end of the stroke in each of the several engines, all drawn to the same scale and on the same principle, so that the comparison of the diagrams will show the relative effect of the steam in the several engines; the same total power being represented in each case.

Fig. 3 shows the variation of power in the Cornish engine, when the steam is expanded down to the limit of useful effect; this is shown by the curved line, A G C. The vertical height of the first division, A D, represents the relative total moving force developed by the engine, in the direction of the revolution of the crank-pin, during the first 15° of revolution from the commencement of the stroke. The heights of the succeeding divisions in fig. 3 represent the corresponding amounts of force developed by the engine during each successive motion of the crank through equal angles of 15° each to the end of the stroke C, and the half revolution of 180°; the force shown being in all cases the amount that would be produced in the circular direction of the revolution of the crank pin, not in the rectilinear direction of the piston. If the amounts of force in these several divisions were all exactly *equal to one another* (and the engine, having attained its state of uniform velocity, were employed to overcome a constant resistance to circular motion, such as driving a corn mill or spinning mill, &c.), then the crank arm would have a perfectly unvarying velocity, and no fly-wheel would be required. And the approach to this constancy of velocity, in any engine applied to overcome resistances to circular motion, will clearly depend on the approach to equality which these amounts of work produced through equal angles make to one another.

The average line, D E, shows this average equal height of all the several divisions; consequently the rectangle, A C E D, represents the equivalent uniform development of power that would produce an unvarying velocity of rotation, and therefore the area of the shaded space, being the deficiency in filling up this rectangle of uniform power by the actual working of the engine (also equal to the portion H of the curved figure that is above the average line, D E), will represent the total amount of variation from the average in the moving force of the engine throughout the stroke. The area of the shaded portion in this diagram is 43 per cent. of the total area, consequently the *total variation* from the average in the moving power of the Cornish engine is 43 *per cent.*, and the *greatest variation* at the extreme point G, amounts to 189 *per cent.* of the mean power.

The total variation from the average power ..	43 per cent.
The extreme variation..	189 per cent.

Fig. 4 shows in a corresponding manner the variation of moving power throughout the stroke in the continuous expansion engine, where the steam is cut off at half stroke in the first cylinder, and expanded in the larger cylinder down to the limit of useful effect.

The total variation from the average power is only 13 per cent.

The extreme variation .. .. 55 per cent.

consequently the *total variation* in the moving power in the Cornish engine is 3 *times* as great as that in the continuous expansion engine, and the *extreme variation* is $3\frac{1}{2}$ *times* as great.

The dotted line, B B, in fig. 3, shows the effect of coupling together two Cornish engines, exactly similar to that shown by the full line in fig. 3, but of half the total power each.

The total variation from the average power is.. 20 per cent.

The extreme variation .. .. 58 per cent.

The *total variation* in the moving power being $1\frac{1}{2}$ *times* as great as in the continuous expansion engine, and the *extreme variation* about equal. This arrangement would of course be much more expensive than the continuous expansion engine, as it involves two complete engines.

Fig. 5 shows the variation of moving power in a Woolf's double cylinder engine, where the pistons work simultaneously in the two cylinders, commencing each stroke together, and the steam is cut off at half stroke in the first cylinder, and afterwards expanded in the larger cylinder down to the limit of useful effect, as in the foregoing Cornish engine.

The total variation from the average power is.. 27 per cent.

The extreme variation .. .. 90 per cent.

consequently the *total variation* in the moving power is 2 *times* as great as in the continuous expansion engine, and the *extreme variation* $1\frac{3}{4}$ *times* as great.

The dotted line, F F, on fig. 4 shows the effect of coupling together two of the continuous expansion engines at right angles to each other, and the result of this arrangement is a remarkably near approach to perfect uniformity of moving power.

The total variation from the average power is only 3 per cent.

The extreme variation .. .. 8 per cent.

The dotted line, F, F, on fig. 3, shows in a similar manner the effect of coupling together three of the Cornish engines with cranks at 120° to each other.

The total variation from the average power is .. 9 per cent.

The extreme variation .. .. 22 per cent.

both being about three *times* as great as in the continuous expansion engine.

Fig. 5 shows also by the dotted line, F F, the effect of coupling together two of the Woolf's engines at right angles to each other.

The total variation from the average power is .. 5 per cent.

The extreme variation .. .. 13 per cent.

both being about $1\frac{1}{2}$ *times* as great as in the continuous expansion engine.

The comparative amount of work performed by the several engines, with the same quantity of steam or of coal in each case, under the circumstances stated above, and taking the pressure of the steam admitted to the first cylinder at 50 lbs. per inch above the atmosphere, is given by calculation as follows :—

Continuous expansion engine	100
Woolf's engine	109
Cornish engine	111

The general result of the above comparisons is, that the *Cornish engine is* 11 *per cent.*, and *Woolf's engine is* 9 *per cent. more economical* in expenditure of fuel than the *continuous expansion engine*, when the expension of the steam is carried to the *extreme limit* in each case; but that this economy cannot be obtained practically in those two engines, on account of the great irregularity in their moving power, the *average irregularity* being, in the *Cornish engine*, 30 *per cent.*, and in *Woolf's engine*, 14 *per cent.*, *greater* than in the continuous expansion engine; and the *extreme irregularity* being 134 *and* 35 *per cent.* respectively *greater*.

Consequently, it appears that, although the expansion of the steam cannot be *theoretically* carried to so great an extent in the continuous expansion engine as in the other engines, yet, from the moving power being so much more uniform throughout the stroke, the expansion can be carried *practically* to a considerably greater exent; and a greater amount of economy may be practically obtained within the same limit of uniformity in the moving power.

A working model, one third size of the engine as applied to a locomotive, was exhibited to the meeting.

Mr. E. Jones observed that the engine appeared to be a step quite in the right direction, but further practical trial was requisite.

Mr. Peacock wished to know the particulars of the trials that had been made.

The chairman suggested that the discussion should be adjourned to the next meeting, as Mr. Samuel, who had intended to be present, was unexpectedly prevented from attending. He proposed a vote of thanks to Mr. Samuel, which was passed.

INSTITUTION OF CIVIL ENGINEERS.

10th February, 1852.

The paper read was "The Construction and Duration of the Permanent Way of Railways in Europe, and the modifications most suitable to Egypt, India, &c.," by Mr. W. B. Adams.

This paper was an historical record and critical examination of the various parts, together forming the "Permanent Way," and of the numerous changes that it had undergone. The requirements that had been gradually developed, as necessary for accomplishing this object, were enumerated, and may be concisely stated to consist in a well-drained substructure, regulated, as regards strength, according to the weight of the engines and the amount of the traffic, firmly seated in the ballast, the rails being stiff enough to resist deflection, sufficiently hard not to laminate, and so broad as not to crush;—smooth, so as to offer the least friction, and properly inclined, especially on curves, so as to fit the wheels, and the joints so arranged as to make the bars continuous, and yet to admit of contraction and expansion.

The different kinds of rails, from the flat tire-bar and edge-rail, used on colliery lines at the time of the introduction of railways—to the parallel and bridge-shape rails now generally adopted, were examined; and also the girder rails, for doing away with the sleepers and other extraneous means of support, in the hopes of effecting a saving in the cost of maintenance. Of the girder rails, the saddle-back pattern, introduced by Mr. W. H. Barlow, M. Inst. C.E., was the one most generally known; but it was suggested, there would be some difficulty in the packing of this rail, and if, as was asserted, it really was a rigid girder, though the draught might be lessened, the tyre of the wheels would roll down the rails to a corresponding angle with themselves. The mode of connexion of this rail, by a piece of nearly similar section, to which it was firmly rivetted, was objected to, on the ground of there being no allowance for expansion and contraction ; the strength of the joint depending entirely upon that of the rivets. Many modifications in the form of the girder-rail were suggested; among them a T section, with a rail, or rib, on the upper surface, and a vertical portion below, giving stiffness, and forming a solid web for ramming the ballast against.

The supports for the rails were next considered, and the reasons for abandoning stone blocks were attributed, in some degree, to their hardness and rigidity, which caused much noise, but principally to the difficulty of packing and maintaining the way, owing to their depth, to the chairs cutting into the stone, and the spikes working loose. The adoption of timber sleepers, first on newly made embankments, afterwards universally—their size and number to each length of rail, and the proportionate area to the length of bearing—to the necessity for their being sunk into the ballast, and yet to have such an amount under them as to prevent their being depressed in the ground, was also treated of, and a comparison instituted between cross-sleepers and longitudinal timbers, from which it appeared, that when their bearing surfaces were equal the quantity of timber used in each would be the same, and, provided the quality was similar in both cases, which it ought to be, the cost of this portion of the way would also be the same. The longitudinal system certainly afforded great stiffness to the rail, and offered greater faci-

lities for packing; but, on the other hand, the timber was more crushed than in the cross-sleepers, the fastenings were less effectual, and were more difficult of access. For the purpose of obtaining greater durability in this portion of the way, and, at the same time to preserve the elasticity afforded by the timber substructure, Mr. Reynolds had designed a combination of wood and iron, the wood, to which the rails were attached, being placed in a cast iron trough, triangular in section, with the apex downwards. This system, however, did not meet with much favour, and more recently various contrivances had been suggested, and in some instances tried successfully, for doing away entirely with the timber work in the substructure. In the "dish-cover" cast-iron sleeper, invented by Mr. Greaves, of Manchester, and now, it was said, about to be used in the Egyptian Railway, the packing was accomplished from the surface, through two small holes; and, in the system introduced by Mr. P. W. Barlow, the rail was held in two cast-iron vices, which formed so rigid a road, that there was not the slightest elasticity in it. A modification of this plan by Mr. W. H. Barlow, in which the sleeper was cast in one piece, with a chair-head on it, and into which the rail was secured by a wooden key, was a slight improvement on the previous method. Mr. Samuel had proposed, that the rail should be held in a compressed wooden cushion, or vice, set in a cast-iron sleeper, or trough, but not continuous; and Mr. Hoby, that the sleeper should consist of an elongated chair of the ordinary form, the rail being fastened in it by means of a pair of folding wedges. From what had been done, it might safely be concluded, that cast-iron might be advantageously employed, provided it was in large masses, and formed a continuous support; unless, indeed, the rails were so strong in themselves as to be non-deflecting.

The different modes of fastening the rails in the chairs at the joint, so important to prevent *déraillement,* were then alluded to, and the failure of the wooden keys, at first used, was attributed to their being ridiculously small; iron spikes were substituted for them, but they also were obliged to be abandoned, when larger wooden keys were again adopted; in some instances they were compressed, like the treenails, by the process of Messrs. Ransome and May, who likewise had introduced a chair to be used with them.

The last point to be noticed in the formation of permanent way, was the establishment of a firm connection between the rails, so as to form them into one continuous bar, and to remove all the evils attending bad joints. On the Blackwall Railway the ends of the rails were originally scarfed—that was previous to the use of locomotives on this line—but this weakened the ends, and reduced the available length of each rail. Subsequently the addition of fishes on both sides of the rails was proposed; various modes of accomplishing the same object were given; at first of cast, afterwards of wrought iron, and then only to touch at the top aud bottom; these fishes were laid in the channel of the rail, and, in the first place, were supported at the ends by chairs, but, as fresh castings had to be made to receive them, it was thought better to have holes in the rails and fishes, and to pass a bolt through all, the holes in the rails being made larger than those in the fishes, so as to allow of expansion and contraction. To meet the objection to the increased cost of this plan, Mr. Samuel, in 1849, proposed that a chair should be cast with only one jaw to fill one channel of the rail, the other being occupied by the fish.

In Egypt the dry heat of the atmosphere was fatal to timber, and the soil along which the line would be carried, would vary from the extreme moisture of irrigated land to parched dust. Therefore the deeper the foundations of a discontinuous sleeper-road could be placed, the better chance there was of their remaining firm. In the flat parts of India two evils had to be guarded against; the one, the floating up of a line during rainy seasons, if much timber was used; the other, the ravages of the white ant, which might possibly be prevented by creosoted timber; but this, in dry weather, would be liable to be fired either by hot coke, or the burning sun. And in both these countries, as well as in the Australasian colonies, where fences and police could not well be maintained, an absence of anything which could be easily pilfered, was a great desideratum; there should be few parts, and easily put together, so as to require little skilled labour, where such labour would be dear.

Under all these circumstances, it was submitted that an iron girder-rail, of simple construction, hollow, so as to preserve as nearly a uniform temperature as possible, under the extreme variations of temperature between day and night, would be the most efficacious, the simplest, and eventually the cheapest.

WATER-TUBE BOILERS.

Boiler-making, after being for many years considered a sort of vulgar mechanical manipulation, seems at length to stand a fair chance of being raised to the dignity of a science. The clangour inseparable from the system of hand-rivetting, caused its banishment from "ears polite," and the ill-concealed contempt with which boiler-makers, as a class of workmen, were regarded, was not, we believe, without effect in retarding the application of science to the subject. Thanks to Mr. Fairbairn's rivetting machine, and the still more elegant invention of Messrs. Garforth, boiler-making has now received the impetus which the application of self-acting tools never fails to impart to all branches of mechanical art; and the increased use of high-pressure steam will, we venture to predict, produce a revolution in our present system of boiler-making. As a correspondent very justly remarks on this subject (p. 111, vol. 1851), "It appears, then, that, other circumstances being similar, the quantity of fuel necessary to vapourize a cubic foot of water at one atmosphere would vapourize the same quantity at four atmospheres, so that, theoretically speaking, the entire force that steam, at a pressure of four atmospheres, creates in passing to a pressure of one atmosphere, is gained without any additional expense of fuel. In practice, there is a small loss, arising chiefly from the greater rapidity of cooling. If the greatest economy is desired, it is necessary, therefore, to combine the use of high and low pressure steam. This principle, applied as in McNaught's, is now making great advances in the manufacturing districts; *but to apply it safely, there must be a decided change in the system of boiler-making.*" With the truth of this we entirely agree. What we call high-pressure steam now, our children will smile at in compassion for their forefathers, who knew not how to construct boilers to work at 100lbs. on the square inch, just as we, now-a-days, admire the discretion of James Watt, who declined using high-pressure steam, lest, in unskilful hands, it should have retarded the introduction of his great invention.

At p. 25, vol. 1849, we stated the problem thus, "A boiler, the heating surface of which shall be composed of *thin tubes*, to allow of the rapid transmission of heat,—which shall have sufficient area of water level to prevent priming,—which shall require as few stays as possible,—be economical in construction,—and be easily cleaned out."

These conditions suppose a system of boilers, in which all the receptacles exposed to the effect of heat should be of a small diameter, to render their bursting innocuous. All the joints must be faced, so that any one defective part can be readily removed and renewed. Cylindrical vessels must be made of thin plates, with the joints welded together instead of rivetted; and, in fact, the apparatus must become a highly-finished piece of engineering, rather than of boiler maker's work. A near approach to this system is that of Dimpfel's locomotive boiler, a drawing and description of which will be found at p. 200, vol. 1851. In this case, the shell of the boiler remains as usual, but the smoke-box becomes a water-space, from which horizontal tubes run to the front of the boiler, entering the fire-box, where they are turned up and pass through the roof of the fire-box. The parts most exposed to wear are obviously those portions of the tubes over the fire, and we suspect that the pump described for maintaining a circulation through them, is rendered necessary by their length, and the smallness of the diameter, which is 2 inches outside, and probably $1\frac{3}{4}$ inch inside.

This boiler is probably as strong as the ordinary boiler, because the weakest point of all locomotive boilers, the roof of the fire-box, is here, in a great measure, shielded from the heat. The flat roof of the flue, in the barrel containing the water-tubes, is weak, but is also protected; and to this we attach much importance, because it is easy to stay a flat surface, and the thing most to be feared is, such a surface being left bare of water, when, if exposed to intense heat, all the stays in the world will not prevent a rupture. Still this boiler has two radical de-

fects: it requires too many stays, and the shape of the tubes renders them difficult to clean out. Neither is it suitable for boilers on a large scale, as the diameter of the barrel is larger than is consistent with high pressures.

As far as strength and convenience of renewal are concerned, probably Dr. E. Alban's boiler, described p. 165, *Artizan*, 1848, is the nearest approach to theoretic excellence. In describing this boiler, we alluded to the want of provision for due circulation of the water, which rendered us sceptical of its durability and evaporative powers. We perceive that some of the engineers in France are adopting the leading points of these boilers, and we shall notice them for the sake of comparison.

The annexed engravings* represent a boiler constructed by Messrs. Legavrian and Farinaux, of Lisle, and for which they obtained half of a

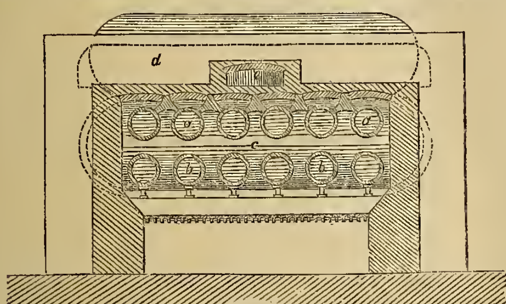


Fig. 1.

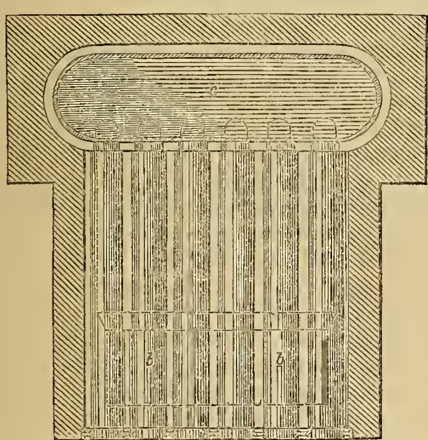


Fig. 2.

prize of 10,000 francs, offered by the Society of Encouragement, for improvements in boilers. Fig. 1 is an elevation in section, and fig. 2 a plan of this boiler. It consists of two rows of generators, *a a* and *b b*, lying immediately over the fire-bars, and communicating at their back ends with the receiver, *c*. The frout ends of the generators are supported by a cast-iron frame, as shown. The brick-work over the upper row of generators is supported by cast-iron bridges laid between the generators; this system leaving the upper sides of the generators free to be acted upon by the heat. The lower receiver, *c*, is kept full of water, and communicates with an upper receiver, *d*, which forms the steam-chest. The flame, after playing round the generators, and the receiver, *c*, passes round the lower side of the receiver, *d*, and through the flue, *e*, to the chimney. No provision appears to be made for the circulation of the water through the generators.

In the boiler awarded the prize, only one receiver of larger diameter was employed, partly filled with water, and surmounted with a vertical steam chest, to give more steam room. The dimensions and performance of that boiler were as follows:—

Length of receiver	9.84 feet.
Diameter of do.	4.19 „
Length of the four lower generators ..	13.77 „
Length of the four upper do.	10.66 „
Diameter of generators	1.31 „
Volume occupied by the water	20 cub. ft.
Do. do. steam	7 „

The coal consumed during the trials was English, large, and of good quality. In the first experiment, the coal consumed per horse power per hour was 2.9 lbs., and the quantity of water evaporated by 1 lb. of coal, 8.06 lbs.

The power obtained (indicated?) was 32 horses.

In the second experiment, the consumption was reduced to 2.77 lbs. per horse power per hour. The trial lasted ten hours, and the power obtained was 39 horses. It is obvious that the consumption per horse power depends upon the engine; but the water evaporated gives not a bad result.

(To be continued.)

* We are indebted for this information to the *Publication Industrielle*, which may be had at the *Artizan* office.

PROGRESS OF AMERICAN INVENTION.

(Continued from p. 37.)

Two couplings, one for hose, and the other for small metallic pipe, have been patented. In the latter device the pipes are cast without either flange or socket; a ring is attached to, and surrounds one of the pipes at a short distance from its extremity. Over the end of this pipe, and projecting beyond it, with its larger end abutting against the before named ring, is slipped a sleeve of soft metal, the exterior of which is the frustum of a cone; over this sleeve is adapted another of hard metal, closely fitting the exterior of the former one. The end of the other joint of pipe is now inserted into the projecting end of the soft metal sleeve, until it abuts against the end of the first named joint. The hard metal sleeve is then driven by a hammer over the soft one, and towards it, the larger end thus compressing it firmly against the periphery, and between the joints of the pipes.

This coupling is cheap, simple, secure, and easily attached and detached.

Two patents have been issued for improvements in lead pipe machines; the novelty in the one consisting in a method of cooling or setting the lead in the cylinder before it is forced through the dies; and the other depending for its patentability upon a peculiar shape of both core and die. Certain minor improvements in the process for making copper pipe without a seam have also been patented.

In the subdivision of this class, under which are examined applications for patents in nail and screw machinery, many patents have been granted; among which are two for cutting the threads of wood screws, and one for nicking the blanks. The improvements in these machines would appear trivial, if not valueless, to those unacquainted with the fact, that apparently slight differences produce important changes in the action of machines, which are required to perform such nice and accurate work as these execute. To those who have traced step by step the improvements in such machinery, which have resulted in the production of the deep threaded, highly-finished American screw, which has taken the place of the rough imported article, but little, if any, superior to a nail, the improvements serving as the basis of these patents, will present themselves as important inventions.

The nail machines present no very important changes or improvements. One of the two patented machines, for feeding nail plates to the cut-nail machine, deserves special notice. It has long been a desideratum to contrive some apparatus which should take the place of the nailor, as he is now termed, who feeds into the jaws of the machine the heated iron plate, lifting it upwards, drawing it backwards, turning it half round, and advancing it again, each time that the machine makes a nail. These mechanics, by long practice, become so expert as to repeat this set of motions 300 times every minute. None of the many mechanical feeders that have been contrived, have answered in practice. The one here noticed, carries the nail plate through all the motions above cited, and is comparatively simple; as far as can be determined by examination, it appears to approach much nearer to

the desideratum than those which have preceded it; whether or not this opinion be a correct one, practice alone can decide.

A machine, which the inventor confidently asserts will supersede manual labour, as employed for beating gold into leaves, has also been patented. The gold in sheets, and protected by animal membrane, as is usual, is adjusted in layers within a frame, which is supported by a marble slab. A trip-hammer, worked by machinery, beats upon the pile, which, in its enclosing frame, is moved hither and thither, and back and forth, under the hammer, by means of cams and levers.

The idea is not a new one; machines of a similar character having been long since employed in France, and I believe abandoned. The claims, therefore, rest upon the particular devices employed by the inventors, to give the requisite motions to the bundle of leaves.

Two improvements in the surface condenser are worthy of notice; in one of these a receiving vessel for the exhaust steam and the water resulting from the condensation of the same, is combined with the condenser proper in such manner, that a considerable quantity of the heat contained in any one portion of exhaust steam is absorbed by the water which has resulted from the condensation of a previous portion of the same. Hotter water is thus supplied to the boilers, and a smaller quantity of fuel is required to evaporate an equal bulk of water.

The other condenser has for its object, to relieve the tubes in which the steam is condensed from pressure, thus obviating one of the great practical difficulties incident to the use of the condenser, familiarly known as Hall's. The tubes in this latter condenser contain exhaust steam and water, resulting from its condensation; their interior surface is in vacuo, or nearly so: their exterior is surrounded by a constantly changing body of cold water, which presses upon the tubes, tending to collapse them, with a force due not only to the atmospheric pressure, but to the height of the column of fluid. These tubes are of small size, and their collective length in some steamers is more than a mile; there are consequently many joints, and these are liable to be broken by unequal expansion and contraction, or by the straining of the vessel. When a leak occurs, the cold water rushes with great force to the interior of the tubes, and a small leak is sufficient, as it is technically termed, to drown the condenser, filling the tubes to such an extent with water, as to forbid access to the exhaust steam, and rendering the condenser useless. To obviate this difficulty, and to render practicable the employment of thin tubes, this patentee originated the idea of admitting the water to the outside of the tubes in such a manner, that in one of his arrangements they should be exposed on their exteriors to the pressure due to the height of the water only; that in the other arrangement, the pressure on both sides of the tubes should be exactly equal, and leakage in consequence produce no evil whatever.

In this last arrangement, the case containing the tubes is air-tight and sufficently strong to resist atmospheric pressure; cold water is admitted to the top of it, and falls in a continuous shower through a perforated plate upon the cluster of tubes, cooling their surfaces, and condensing the steam within them; as it collects at the bottom it falls by gravity into the well of a pump, which latter lifts out the water. Openings are made through the tubes, connecting the space outside with that inside them, and thus an absolute uniformity of vacuum in the two spaces is maintained. This condenser has been in actual use for several months; report speaks highly of its performance, and it is stated that it is as little liable to injury as the ordinary injection condenser, while it at the same time returns back to the boiler the steam condensed and unmixed with salt or impure water, as is the case in Hall's condenser.

Navigation and Maritime Implements.—In this class, some six-and-twenty patents have been granted, among which is one for a peculiar form of vessel, scow-bottomed with keels at the sides projecting below the bottom, and below the water-line at both bow and stern. By such a form, a wedge, as it were, of air with its edge towards the vessel is enclosed at the bow, by the keel, by that portion of the bottom which projects over the water, and by the surface of the water itself. As the vessel is forced onwards, and waves strike in this wedge-shaped space, each one in its turn forces a quantity of air under the bottom, and below the surface of the water; this air is retained in contact with the same until it makes its way out astern, being prevented from issuing at the sides by the keels before cited. A patent was some years since granted for applying air to the bottom of vessels; thus, in fact, supporting them on a thin layer of air, and alleviating the friction arising from the passage of water along the outside planking, which friction has of late years been discovered to form an important element among the resistances which oppose the progress of vessels. A vessel built on this better plan, in which the air is discharged under the bottom by powerful pumps, is now in actual use in the harbour of New York, and with fair success. The patent granted the present year has been presented as an improvement on this plan, and the inventor states that his peculiar model will enable him to dispense, not only with the pumps, but with the power necessary to work them.

An arrangement of two flexible bars connected to each other, and to a rigid bar between them by means of cross pieces, which are free to slide on the rigid bar, and can be clamped to it at any required point, has been patented. The whole apparatus constitutes a rule, the outer edges of which can be made to assume many different curves. Its object is to save the wood and labour employed in making the patterns or moulds, from which timbers for vessels are cut. The rule is set to the chalk lines on the laying down floor, and the position of the cross pieces with respect to the rigid bars is noted and marked; it is then set to the lines representing another timber, and so on for any convenient number. The rule is then carried to the yard, re-set by the marks in its previous positions, and the outline of its edges marked on various sticks of timber.

Fire Arms, Implements of War, &c.—Similar causes to those which led to a diminution of the numbers of the gold washers, presented to this office for examination, have acted upon the minds of those engaged in the manufacture or improvement of fire arms, and but fifteen patents have been granted during the past year in this class. Two of these are for improvements in the sliding piston breech gun, one of them being for a method of moving and holding the piston, and the other for certain apparatus for preventing accidental explosion of the charge, while the operation of loading is proceeding.

Several patents have been granted for modifications of those arms familiarly known as Cochrane's and Colt's.

Two of the latter have been issued to the original inventor, one of them being for certain improvements in the form of the locking notches of the revolving breech, which prevents any one chamber of the same form being thrown past the axial line of the barrel, and for arrangements rendering it impossible for the charge to explode when the pistol receives a violent fall or jar. The other consists in permitting the spindle on which the cylinder revolves to pass only partially through the hole in the latter, and in closing up that end of the same, which is nearest to the barrel. The improvements claimed under both patents will remedy certain defects of the pistol, as at present manufactured, and the one last noticed is believed to be especially important, as it prevents all smoke, dirt, small pieces of lead, &c., from entering between the spindle and the cylinder, and obstructing, if not entirely preventing its revolution.

Patents have been granted for several improvements in that class of locks in which the hammer is raised and discharged by the same trigger. One of these is based upon such an arrangement of the parts, that one pull cocks the lock and leaves all the parts held in position, as in an ordinary lock when cocked; a second pull of the same trigger, but requiring much less force, will then discharge the piece. Two advantages result from this arrangements when applied to fire arms with revolving barrels; one being that the arm is not thrown out of the line of aim by the violent pull on the trigger in the act of discharging; the other that the barrel is at rest before it is discharged, and the ball has only the motion derived from the explosive force of the powder, and not the compound motion derived both from it and from the revolution of the barrel, as is usually the case.

Agriculture.—A patent was granted for a *Seed Planting Barrow*. In this the gist of the invention lies in the device for receiving and transmitting, or distributing the seed. It is so constructed that the reciprocating, semi-rotating, horizontal seeding disk, takes the seed from the hopper above it into its seed measuring cups, in which cups the seed is carried around on the surface of the under lying plate, until it is brought over a hole in the said under plate, through which it falls into the furrow. The patentee claims the devices for moving the seed disk in combination with the disk itself.

A patent was granted for the construction of a *drill tooth*, so that when it should meet with a fast rock or stump, or other fixed obstruction, it might disengage itself without the danger of being broken. Devices for accomplishing this result are rather common within the last year or two. The tooth in this case is so made, as to be hung by a pivot at its top, and to be grasped at its front and middle part by the lips of a pair of tongs, the jaws of which project horizontally backwards, and hold the tooth with sufficient force to resist the action of ordinary soils; but if the drill tooth meets with any fast obstruction, it pulls away from the grip of the tongs, and swings back on its pivot, and, when it has past the obstruction, may be pressed between the jaws of the tongs by the attendant.

A patent was also granted for a *Planting Cylinder*, in which the invention consists in the device for varying the size of the seed cavities in its periphery. This is done by means of an arrangement of radial bars or rods like the spokes of wheels running towards the periphery, and extending into the bottoms of the seed cavities, and thus filling them up in the whole or in part only. The radial arms or rods are moved in mortised grooves outward and inward, by means of cams working in screw thread depressions. The cylinder being composed of two short cylinders or disks on the same shaft, one having the cams, and the other the screw thead depressions, so that by rotating the inner faces of the disks upon each other, the radial arms are advanced or retarded, so as to vary the size of the cavities in the seeding rollers.

A patent was granted for a *Seed Distributing Apparatus*, in which the invention consists in the use of cogs of wheels having their peripheries pass through the hopper of a seed planter, and each cog takes up and carries over a small quantity of seed and deposits it in the seed drills; there being one drill tooth for each cog-wheel.

Another patent was granted, the gist of which consists in the arrangement and in the working of the seed valves in the bottom of the hopper, in combination within one of the sides of the hopper, so made as to slide up and down, and thus vary the capacity of the seed measuring space, contained between the upper and lower slide valves, by causing the valves to recede from or approximate towards each other. In sowing seed, tbe two series of valves move alternately, the upper being opened first, lets down its charge upon the lower one, while the latter is yet shut, and as soon as the upper one is closed, the lower one is opened, and the seed falls into the furrow. The upper and lower valves, each is worked by a separate set of cams on the driving axle.

Cart for Spreading Manure.—A patent was granted for this apparatus, consisting of the sides and ends of a manure cart body on a pair of wheels on the axle of which the body is capable of being slided rearward, or run back on rollers for the purpose of the discharge of its contents. The bottom part of the said cart-body, or box, is made to consist of an endless apron on a series of rollers, the forward end of the apron is made fast to the forward end of the box, while the near end of the apron winds up on a roller situate underneath and near the rear end of the cart. It discharges the contents as the body of the cart moves or slides backward. The manure is spread by winding up the rear end of the apron on the under roller, which process brings the contents slowly backward, and distributes them broadcast or otherwise, at the rear of the cart body.

Harvesters.—Under this division, fifteen patents have been granted. For the last two years much attention has been given to this class of agricultural machines. At first they were confined to the cutting of grain chiefly, then to grain and grass, and now they have been extended to almost every herbaceous growth of the soil. Thus we have grain and grass harvesters, corn harvesters, cornstalk harvesters, cotton harvesters, cotton stalk harvesters, cloverhead harvesters, hemp harvesters, &c. I shall notice several of these, as they present something of interest, to prairie farmers especially.

The first machine which I shall mention in this class, is a *machine to harvest Cotton Stalks* in the field. It is a machine having two horizontal shafts, running from side to side. The upper and forward one has radial knives or beaters, which rotate rapidly, and beat down the stalks, while the rear shaft is supplied with radial longitudinal knife edges extending from side to side, and as the blades come down they chop the stalks in pieces.

The second machine noticed under this division, is a *Grain and Grass Harvester*, presenting two principal points of invention. First, the cutters, which consist of two horizontal saw blades, lying flat upon each other, with the teeth looking forwards, and vibrating upon each other as the face of the saws is pushed forward against the standing grass. The peculiarity of these teeth consists in their being made concave on their inner faces, so that when they slide past each other, they cut somewhat on the scissors principle, and are, to some extent, self-sharpening. Secondly, there are what are called cyma-reversa fingers, working in combination with certain rake teeth, designed to hold the charge while the fingers take it and deposit it upon the ground.

The third machine of this division is a *Corn Stalk Harvester*, the frame of which resembles a low three-wheeled truck, and bearing upon its upper surface, near its middle part, two broad metallic disks, armed with teeth on their peripheries, which teeth slightly overlap each other, and are capable of seizing and holding within their grasp any herbaceous matter, and as the machine moves forward, to tear it up by the roots. The meeting of these teeth is near the central part of the machine, anterior to which the space is perfectly clear, so that when the machine is driven over a row of the corn stalks, the latter are successively brought against the teeth of the metallic disks, and drawn out of, and deposited on, the ground.

The fourth machine is an ingenious contrivance for distributing the cut grain of a harvester into suitable parcels for bundles, by the weight of the grain. It is called a *grain binder.* It consists of a self-regulating rotary cylinder, mounted on the rear end or extreme right side of the machine, and having its axle parallel with the rear end of the machine. This cylinder is supplied with catches and springs, and so arranged that when a certain weight of grain is received into one of its three compartments, it performs a third part of a revolution, and deposits the amount received for a bundle, while the next compartment of the cylinder is being charged for a second bundle, and so on.

One patent has been granted for a *machine to harvest hemp*, a prominent peculiarity of which consists in the method of severing the stalk, by means of an oblique chop stroke of the cutters falling obliquely across the spaces between the fingers, and upon the edge of the finger on the further extremity of the finger space; the oblique stroke being given by the shaft on which all the cutters are arranged, which shaft is semi-rotated in screw thread bearings, so that the shaft, in so rotating and re-rotating as to raise and depress the cutters, should, in performing this operation, give the oblique motion which severs the stalk, as set forth.

Two machines, adapted to harvest maize have been patented. The first of these contains a thresher to husk and shell the grain. The harvester consists of a machine, in its general arrangement not unlike a clover head harvester. But it has a series of pairs of rollers, one pair between every pair of teeth, to seize the stalks and pull them downwards, until the ear is drawn against the tops of the fingers by which the ear is severed from the stalk. The ear then rolls down an inclined plane to the thresher. A *second machine for harvesting maize or grain* has also been patented. The gist of this invention consists in the construction of the grain reel, made with rows of fingers, projecting radially, and rotating over or through the standing grain. The stalks being received between the fingers, the ears are pulled off and deposited on an inclined endless apron.

A *Grass Harvester* of a novel construction has been patented, which it will be difficult to describe without the aid of drawings. Some idea of its general character, however, may be formed, by supposing a flat washer-like ring of metal to be cut out of a sheet of metal, and placing it in a horizontal position. Now place upon its surface, symmetrically, a series of sharp razor-blades, a few inches apart, having the shank confined to the ring by a screw or rivet, and the ends of the blades projecting beyond the periphery of the ring. If now the ring be rotated, so that the cutting faces of the blades be forward, and in this state be brought against the standing grass, it is contended by the inventor that the machine will be a successful instrument. The cutting blades are supported in their position by suitable contrivances, and the ring, with its cutters, has also suitable devices for supporting it, and rotating it as the carriage moves forward, which it is unnecessary to refer to here.

Horse Rakes.—Only one apparatus under this division is regarded worthy of notice, although six patents have been granted.

This invention is denominated *a machine for Binding Grain.* The frame of it resembles the platform of an ordinary harvester, so constructed that curved rake teeth, projecting upward through the floor, and passing across the same from side to side, collect the grain at the opposite side, where it is

brought against a curved arm, between which arm and teeth the grain is pressed, and at the same moment another curved finger rises through the floor from behind, to support that half of the bundle, while at the same time, the curved rake teeth, by means of the machinery, fall backward through the floor, and are carried back to the opposite side of the platform, or to the starting place, for a new charge.

The gearing could not be explained without a drawing. The only part required of the attendant with the machine, is to tie the band for each bundle or sheaf.

Thrashing Machines and Grain Separators.—Five patents have been granted; two thrashing machines, and three for separating the grain from the straw, or for carrying away the straw after thrashing. I shall notice only one of these, namely, a thrashing cylinder. This cylinder is constructed in short sections or rings, in such manner as to be slipped over a solid cylinder, and made moveable on it, so that when any one section receives a stone or other hard body between the teeth, instead of its breaking out the teeth, the ring will slip round the solid cylinder, and thus allow the obstruction to pass through the machine without doing injury.

(To be continued.)

THE SMOKE QUESTION.

(Continued from page 32.)

Our articles on this subject have drawn down upon us the wrath of more than one patentee; some, because we have not noticed them favourably, and some because we have not noticed them at all. To one of the last we must do justice on the present occasion.

We have described Godson's patent furnace, in which the coal is introduced from below, and the smoke is consumed in passing through the red-hot fuel. The one before us—Mr. Coupland's—is on the same principle, but differs in the arrangement of the bars, and is, we think, so far better than the other. Fig. 1 is an elevation of the front of the furnace of a waggon boiler, and fig. 2 is a plan of the furnace in section. From the plan it will be perceived that in the centre of the fire-grate there is a series of bars below the level of the rest of the bars, which are marked *g*, in the elevation. This series of bars is lowered in the following manner:—A series of false bars, *f*, are arranged so as to slide up and down in a cast-iron box below the fire-grate. Motion is communicated to these by a segment, *c*, moved by a pinion and handle, *a*. When the bars, *g*, are lowered, they form the bottom of the box, which is then filled with coal, and the grating is gradually raised as the coal is consumed. The form of the lower grating, *f*, affords admission for a supply of air to the centre of the furnace—an advantage which is not obtained in Mr. Godson's arrangement.

The centre bars can be sustained in their position by catches, so as to convert the furnace into an ordinary one, and provision is made in case, on lowering the bars, the fuel above them should not be sufficiently coked to sustain its position; this consists in a few bars, *k k*, which can be moved transversely across the opening, by a lever to the left of the furnace. Mr. Coupland has applied his plan to a cylindrical boiler, at Whitbread's brewery, and we shall take an early opportunity of inspecting it and report progress.

(To be continued).

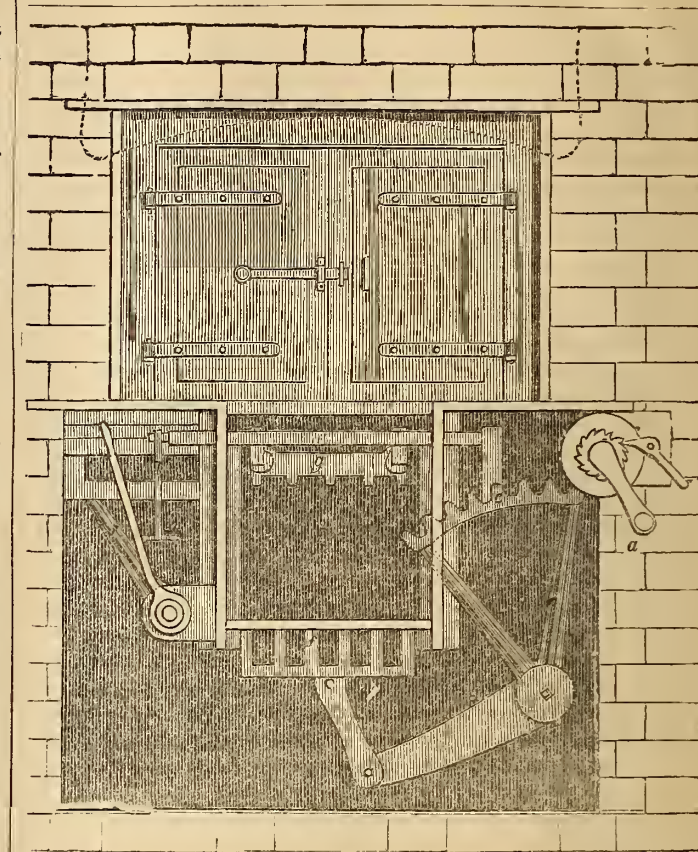


Fig. 1.

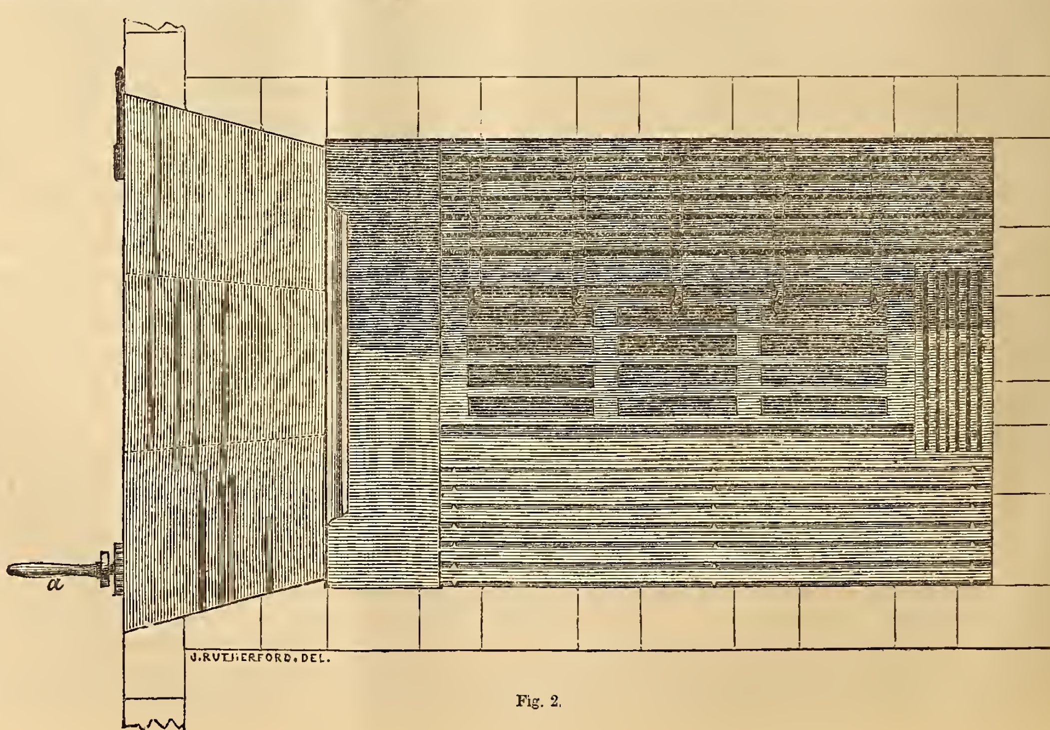


Fig. 2.

NOTES BY A PRACTICAL CHEMIST.

Test for Urea.—If a solution of pure urea is made highly alkaline by means of caustic potassa, and a solution of perchloride of mercury gradually added, a compound of urea with the peroxide of mercury is thrown down in the form of a shining white precipitate. A weak solution of perchloride of mercury may be mixed with bicarbonate of potassa in excess, without immediate precipitation; but if a solution of urea be added, the above-mentioned precipitate is at once thrown down. In this manner, 1-5000th of urea can be detected in a liquid. The whole of the urea contained in urine, and other animal fluids, may thus be precipitated.

Active ingredient of Ergot.—Dr. Winckler has extracted from the ergot of rye, a new volatile organic alkali, very similar to conia. It is to this substance, and not as commonly supposed to ergotina, that the remarkable effects of ergotised rye are to be ascribed.

ANSWERS TO CORRESPONDENTS.

"A Pharmaceutist." Your question does not admit of a satisfactory answer in the present state of chemical science. Dr. Runge proposes the law, that colouring matters, when pure, are tasteless and inodorous, and have little or no action upon the animal economy; whilst, on the other hand, bodies possessed of intense taste, odour, and powerful physiological action are chiefly colourless. Of the latter class of bodies, the organic alkalies, and their salts, are a striking instance. Exceptions to this law are meanwhile not wanting; but it is far from improbable that many of them may disappear on a more rigid examination. We think it at all events certain, that great solubility and high tinctorial power are very rarely found united.

"Zeta." Peroxide of barium may be formed by passing a current of oxygen gas over the protoxide at a very gentle red heat. Atmospheric air may be used instead of oxygen, if previously freed from carbonic acid, by means of hydrate of lime.

"Senex." Any views you may bring forward, if based upon experiment, will claim and receive respectful consideration, how widely soever they may differ from received notions. But if you appeal to "authority" you nonsuit yourself at once. No assertions, and, we may add, no *à priori* reasoning, can avail against the facts of an analysis.

"S. P., Coventry." We are acquainted with the process, but, for obvious reasons, cannot divulge it. If you try you may discover it, or perhaps something better.

"Cleanliness." All attempts to prepare chlorinated soaps have hitherto proved unsuccessful. *Washing powders* consist of carbonate of soda, with a sufficient amount of lime to render the soda caustic. All that we have examined have a pernicious effect upon linen and cotton goods. S.

SPECIFICATION OF IRON STEAMERS FOR CARRON COMPANY.

We had an opportunity, a few days since, of inspecting one of two sister vessels, the *Carron* and *Clyde*, built and fitted by Messrs. Smith and Rodger, for the Carron Company. They are iron auxiliary screw vessels, and have an average speed of 8 to 9 knots. The engines are on the four-piston-rod plan, with toothed gearing, and are very creditable specimens of workmanship. The intermediate shaft *looked* rather slight, across the arms of the crank for working the air-pump; but the engineers have had so much experience, that we doubt not they are of the same proportions as they have found stand in other boats. The starting gear might be improved to a slight extent, to give the engineer more command over the engines. The locomotive plan of the link does not appear to find much favour on the Clyde.

The following particulars are extracted from the specification, and will be found useful.

Length of keel and fore rake	160 feet.
Breadth of beam	23 „
Depth of hold..	$14\frac{1}{2}$ „
Keel of hammered iron	5 in. × 2 in.
Stem ditto	5 in. × 2 in.
Stern post, ditto	6 in. × 3 in.
Inner stern post, ditto	6 in. × 3 in.

Iron in hull: best Staffordshire plates and angle iron, or iron equal in quality thereto. Rivets in keel and stern posts of Lowmoor or Bowling iron, remainder of best rivet iron.

Frames of angle iron, 4 × 3 × $\frac{3}{8}$, 18 inches from centre to centre.

Plating: the garboard strake to be $\frac{9}{16}$ inches for 60 feet amidships, rest half an inch. Fifty feet of bottom amidships to round off bilge, half an inch; remainder of bottom and sides to the 10 feet water line to be $\frac{7}{16}$, and not less than two feet in breadth. The whole to be lap-riveted horizontally with flush vertical joints.

Riveting: bottom to five feet water line to be double riveted horizontally; remainder single riveted, except the vertical joints of shear strake for 80 feet amidships, which shall have four rows of rivets.

Floorings: one to every frame, 15 inches deep × $\frac{3}{8}$ inches thick, with angle iron 3 × 3 × $\frac{3}{8}$, running up the bilge to the six feet water line; every alternate frame to have a reverse angle iron up to deck, $2\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{1}{4}$, to take ceiling. Floors to extend nine feet on each side of keel.

Keelson: a plate put in fore and aft between the floorings, or keel, of same depth as floorings, with a double angle iron, 3 × 3 × $\frac{3}{8}$ running horizontally fore and aft whole length of ship, and riveted to reverse angle iron of each floor.

Sister keelsons: two in number, about 60 feet in length, same depth as floors at their termination.

Stringers: main-deck stringers of angle iron, 3 × 3 × $\frac{7}{16}$, with plates 16 inches × $\frac{3}{8}$ inches, running all round the ship. 'Tween deck stringers of angle iron, 5 × 3, back to back, to run fore and aft.

Main and 'tween deck beams of angle iron, 6 × 3 × $\frac{3}{8}$, one to every alternate frame; ceilings in proportion. Each beam secured to ship's side by $\frac{3}{8}$ in. hanging knee, 18 inches both ways. Stanchions fitted to every alternate beam.

Bulkheads: four in number, of $\frac{5}{16}$ inch plates, well stiffened with three-inch angle iron, and made perfectly water-tight. Rudder of best hammered iron, stock four inches diameter, plated with $\frac{3}{16}$ inch plates, well secured.

Engines: two engines, cylinders 36 inches diameter, 3 feet stroke; air-pump chambered with brass; buckets, valves, &c., of brass; air-pump rod, covered with brass; full-sized feed and bilge pumps, with brass plungers, one of each to each engine; one pump to be fitted so as to throw water on deck for the purpose of extinguishing fire. The whole to be of strength to carry 20 lbs. steam per square inch over the pressure of the atmosphere, and to be finished in a manner equal to that of the first-rate engine make, wrought-iron being adopted where preferable.

Boiler to be tubular, of strength to support 20 lbs. per square inch pressure of steam, and to be of capacity to supply steam at from 12 lbs. to 15 lbs. pressure per square inch at full stroke and speed, with mercury gauge and gauge-cocks complete.

Coal bunker to stow 80 tons coals.

All materials to be of best quality and workmanship, &c., &c.

To be equal in finish and speed to any vessel of similar dimensions and power hitherto built on the Clyde.

STEAM-SHIP BUILDING IN THE UNITED STATES.

(Communicated hy Chas. W. Copeland, Esq., Engineer, U. S. N.)

SCREW STEAM SHIPS "PIONEER" AND "CITY OF PITTSBURGH."

The former built to run hetween New York and Liverpool, the latter hetween Philadelphia and Liverpool. The engines and hoilers designed and constructed at the West Point Foundry.

	Pioneer.		*City of Pittsburgh.*	
	Ft.	In.	Ft.	in.
Length of keel	213	0	245	0
Do. on deck	225	0	250	0
Beam out to out	43	0	40	0
Depth of hold	24	0	24	0
Do. to top of house ...	31	0	31	0

Each vessel is fitted with a pair of vertical trunk engines.

	Ft.	In.	Ft.	In.
Diameter of cylinders ...	0	85½	0	85½
Diameter of trunk ...	3	3	3	3
Effective diameter of piston	0	76	0	76
Length of stroke	4	3	4	3
Diam. of propeller (three-hladed)	16	0	16	0
Length of do. fore and aft ...	5	0	5	0
Pitch of propeller at periphery	34	0	36	0
Do. at huh	27	6	29	6
Area in square feet ...	108	0	108	0
Diameter of propeller shaft...	1	5	1	5
Whole amount of fire surface in square feet	7,279	0	8,028	0
Area of fire-grate ...	217	0	226	0

Estimated numher of revolutions — average 36, maximum, 41.

Average pressure of steam, 15 lhs. cut off at half stroke.

The *Pioneer* has two iron hoilers, each 29 feet long, 16 feet wide, 9 feet 9 inches high. Cylindrical steam chests, with chimney through, 8 feet 9 inches diameter × 18 feet high. Four furnaces in each hoiler, 8 feet 6 inches long × 3 feet 4 inches wide. The tubes are hehind the furnaces, and each furnace has, first, two tuhes 18 inches diameter; secondly, twelve return tuhes ahout 8 inches diameter; and, thirdly, two tuhes at the hottom, 18 inches diameter, which carry the draft hack to the common smoke-hox. Area of first flues, 29 square feet; second do., 30.4 square feet; third do., 27.25 square feet. Area of chimney, 32 square feet; height of do. ahove grate, 59 feet 6 inches.

The *City of Pittsburgh* has three hoilers, of a similar construction to the last, each 30 feet long, 9 feet 9 inches wide, and 11 feet 10 inches high. Three furnaces in each, 8 feet 6 inches long × 3 feet 4 inches wide. Area of first flues, 28.4 square feet; second do., 37.6 square feet; third do., 28.4. Area of chimney, 37.6; height of do. ahove grate, 59 feet 6 inches.

Now Building	*Boston.*		*New York.*		New vessel.	
	Ft.	In.	Ft.	In.	Ft.	In.
Length of keel	165	0	165	0		
Length on deck	...		...		175	0
Beam moulded	26	0	26	0		
Beam out to out	...		...		28	0
Hold	11	3	11	3	11	6
Engines, inverted cylinder	0	34	0	30	0	44
Stroke	0	30	0	30	0	33
Diameter of propeller, 3 blades	9	9	9	6	11	3
Length fore and aft ..	3	6	3	3	4	0
Pitch at periphery ...	21	6	21	0	25	0
Do. at hub	19	0	18	6	22	6

"JAMES ADGER."

Length of keel, 215 feet; beam moulded, 33 feet; hold, 21 feet. One side lever engine, 75 inches cylinder × 8 feet stroke. Water wheels, 28 feet diameter over buckets × 8 feet face, and 21 inches hucket. 22 arms and huckets.

These vessels are all fitted with Allen and Noyes' patent metallic packing.

THE U. S. SCREW PROPELLER STEAMSHIP OF WAR, *SAN JACINTO*,

By Chief Engineer B. F. Isherwood, U. S. Navy.

This fine war steamer has just heen completed and her trial trip made. A correct account of the vessel and her performance will he of general interest, and also professionally valuahle.

The *San Jacinto* is one of the four steamships of war commenced hy the U. S. Government in 1847, viz., the *Powhattan*, *Susquehanna*, *Saranac*, and *San Jacinto*, all of which, with the exception of the first named, have heen completed. With the exception of the last named, they all have the common paddle wheel. The *Saranac* and *San Jacinto* are of precisely the same dimensions and model, the intention of the government heing to make the two vessels as nearly identical as posssihle, in order to try the relative merits of the two systems of propulsion.

It was originally contemplated to use for the stern arrangement, a *combination*, patented hy Ericsson, in 1849, the claim on which is as follows:—

"What I claim as my invention and desire to secure hy letters patent is, the ahove described location or arrangement of the propeller shaft, in comhination with the rudder made with a slot or recess to admit of the play thereof, substantially in the manner and for the purpose specified."

Which purpose and manner is specified in the said patent as follows :—

"Prior to my invention, the leading objections to the use of a propeller at the stern of a ship, was the weakening of the ship hy cutting the stern to form a recess for the propeller forward of the rudder, and thus carrying the stern post, or the part with which the rudder is connected, so far hack as greatly to reduce the stahility of the structure. To avoid this, the use of two propellers, one on each side of the run of the ship, was essayed, hut this is well known to he even more ohjectionable, as the shafts in that case must pass out through the run of the ship so far from the stern post and keelson, to have sufficient room hetween the axis of the propeller and the run of the ship for the semi-diameter of the propellers, as greatly to strain the ship, and requiring, in addition to the complexity consequent on two propellers, outriggers at the sides for the support of the projecting part of the shafts, which for sea purposes is highly ohjectionahle.

"Another serious ohjection was, the difficulty of access to the propeller for the purpose of repairs, and the resistance presented hy it when sailing alone.

"To ohviate these and other minor ohjections, not necessary to enumerate, was the object of my invention, the principle or character of which consists in passing the shaft of the propeller through the run of the ship, and hy the side of the stern post, that one of the bearings may be attached thereto for strength and stability, the propeller heing placed ahaft the rudder, and as this location of the shaft would of necessity interfere with the play of the rudder, this part of my invention consists in comhining the location of the shaft and the propeller with the rudder made with a slot commencing at the outer edge, that it (the rudder) may have the requisite play."

The ahove arrangement was so far from heing a novelty or invention hy Ericsson, that it was proposed to the French minister of marine in a memoir addressed to him in 1841, hy the commandant, Henry Lahrousse, and printed in 1843. On page 75 of the appendix to this memoir, under the head of Hull, will he found the following:—

"Si le faux étamhot était en hois, il faudrait, pour qu'il ne fût pas affaibli outre mesure, par l'ouverture nécessaire au passage de l'arhre, lui donner une épaisseur considerahle, ce qui nuirait à l'action de la vis et à la marche, par suite du remous occasionné en arrière; on pourrait néanmoins faire passer l'arhre tangentiellement à l'un des cotes du massif."

Which I translate literally as follows :—

"If the false stern post were of wood, it would he necessary, in order that it he not too much weakened hy the hole for the passage of the shaft, to give it considerahle thickness, which would he injurious to the action of the screw, and the speed (of the vessel), hy reason of the eddy caused astern; one could, nevertheless, pass the shaft tangentially hy one of the sides of the dead wood."

It may also he as well to remark, *en passant*, that the use of *two* propellers was never proposed, except for vessels of very light draft proportionally to their displacement, and then the reason for using them was, to ohtain sufficient propelling surface; furthermore, the passing of the propeller shaft through the dead wood of the vessel, tangentially hy the side of the stern post, weakens the stern of the vessel quite as much as passing the shaft through the stern post, while the serious inconvenience follows, of throwing the engines and shaft of the propeller out of the centre of the ship. In the *San Jacinto*, the axis of the propeller shaft is 20 inches to port from the centre of the ship.

The foregoing plan of Ericsson's was persevered in hy the late engineer in chief of the navy, Chas. H. Haswell, who designed the hoilers, engines, and propeller (proposed not executed propeller), as late as Decemher last, when he was superseded hy the present Engineer in Chief, General Charles B. Stuart, who, disapproving the propeller and general stern arrangement of the vessel, which was not then completed, though the engines and hoilers were finished and in their places, a Board of the chief engineers of the navy was ordered hy the Navy Department to examine the vessels, and propose whatever modification they deemed judicious. The report of this Board fully sustained, *seriatim*, the objections of General Stuart, and proposed the present plan of stern arrangement and propeller, which was at once executed.

In this arrangement, the propeller (of entirely different proportions from that designed by Mr. Haswell) was placed next the stern post of the vessel, and a metallic rudder was curved over and abaft the propeller, being attached to the stern post above and below the propeller. The invention of this stern arrangement was made by myself, and adopted by the Board.

Engines.—The engines consist of two inclined cylinders with vertical air-pumps; the cross-heads, being placed at the upper extremity of the cylinders, are connected to a double set of cranks by two connecting rods to each cross-head. The engines are connected by drag links.

The cylinders are $62\frac{1}{2}$ inches diameter and 4 feet 2 inches stroke of piston. Space displacement of both pistons per stroke, 179.54 cubic feet.

Cost of engines (exclusive of boilers and propeller) ..	105,247 dol.
Total breadth occupied by engines, between extreme points ..	29 ft.
Total length	23 1.6
Total length from centre shaft to top of steam pipe	$9\frac{1}{2}$

Boilers.—The boilers are of copper, and three in number; they contain, in the aggregate, $195\frac{5}{8}$ square feet of grate, and 5,250 square feet of heating surface. They are of the double return drop flue variety. Cross area or calorimeter of first flues, 35 square feet; of second flues, 35 square feet; of third flues, 32 square feet; area of smoke chimney, 34 square feet; height of ditto above grate, 65 feet; proportion of heating surface per cubic foot of cylinder, $17\frac{3}{4}$ square feet; aggregate weight of copper in the three boilers, 214,575 pounds; cost of ditto, 53,054.56 dollars; cost of labour on boilers, 39,705.53 dollars; making the total cost of boilers 92,760.09 dollars.

The different kinds of copper were furnished in the following quantities and prices :—

157,892 pounds of	plates at	28 cents per pound.
38,386 „	bolts „	25 „ „
18,297 „	rods „	$25\frac{7}{8}$ „ „

The three copper boilers of the *Saranac*, containing 5,127 square feet of heating, and 188 square feet of grate surface, designed by Chas. W. Copeland, contained the following quantities of copper at the annexed prices:—

137,703 pounds of	plates at	28 cents per pound.
28,331 „	bolts „	25 „ „
27,927 „	rods „	26 „ „

Total, 193,961 pounds.

The boilers of the *Saranac* are of the same length, breadth, and height as those of the *San Jacinto;* cost of materials in the boilers of the *Saranac*, 53,150.27 dollars; of labour on ditto, 23,747.55 dollars; making their total cost 76,897.82 dollars, or 15,882.27 dol. *less* than those of the *San Jacinto.*

Propeller.—The propeller originally designed by Mr. Haswell, and condemned by the Board of chief engineers, was $14\frac{1}{2}$ feet diameter, $4\frac{3}{4}$ feet long on axis at periphery, with an initial pitch of 35 feet, expanding to 40 feet at the posterior end. The area, viewed as a disc, was $115\frac{1}{2}$ square feet. The helicoidal area was 399 square feet; number of blades, six.

The propeller recommended by the Board, and executed for the vessel, was $14\frac{1}{2}$ feet diameter, 4 feet long on axis at periphery, 4 feet long on axis, at a diameter of $7\frac{1}{2}$ feet, thence tapering to $2\frac{1}{2}$ feet long on axis at hub, with an initial pitch of 40 feet, expanding to 45 feet at the posterior end. The area, viewed as a disk, was 65.48 square feet. The helicoidal area was 112,677 square feet; number of blades, four; space between the front edge of the propeller and the stern post of the vessel (left for the rudder), six feet.

The reason why the Board recommended the increased pitch was, that the engine would, with that pitch, consume all the steam that the boilers could generate, cutting off at one-third the stroke of piston from the commencement; while the complex design, with the numerous joints and connexions of the engines, rendered it unsafe to work them at the velocity required in order to make the proper speed of the vessel, with the lower pitch of Mr. Haswell. The reduction in length was for the purpose of diminishing the surface of the screw, practice and theory both demonstrating the posterior portion of the blade to be of small efficiency compared to the anterior portion. In Mr. Haswell's propeller, a large portion of the surface of each blade overlapped or reacted on the one following, which portion was useless for propulsive effect, and detrimental from its friction on the water. The six blades of Mr. Haswell's propeller were too numerous, not allowing sufficient space for solid water to enter between them, being as objectionable in this respect as too many paddles in a common paddle-wheel, where it is well known that with the usual proportions, each alternate paddle can be left out without sensibly increasing the slip of the wheel. Besides, with the six-bladed propeller, there is encountered one-half more direct resistance from the thickness of the advancing edges of the blades, than with the four-bladed propeller, and the six blades have also one-half more resistance to overcome from the *adhesion* of the water to be divided by the blades. That this latter resistance is considerable, is proven by the experiments of Faraday, who ascertained "that the cohesive of every square inch of water is equal to several hundred pounds."

The alteration of the relative positions of the rudder and propeller was for the purpose of diminishing the leverage of the propeller weight on its shaft and on the stern of the vessel, as it had no out-board support. These were the principal reasons that controlled the Board in their proposed changes. The Board also estimated the slip of the propeller at 22 per cent.

The weight of the bronze propeller, as cast and placed in the vessel, is 14,894 pounds; cost of ditto, 7,457 dollars.

The weight of the Stevens' bronze propeller for the U. S. steam-ship, *Princeton*, was 15,970 pounds. It was $14\frac{1}{4}$ feet diameter, 5 feet long on axis at periphery, and composed of six blades, having a pitch of 32.44 feet.

Performance.—The *San Jacinto* being brought to a draft of 15 feet 7 in. forward, and 15 feet 9 inches aft, was tried in New York Bay, Oct. 1st, 1851. She made, in running a distance of $17\frac{3}{4}$ statute miles, taken from the chart published by the U. States Survey Office, 9.95 statute miles per hour against a strong wind on the port bow, estimated by the experienced pilot on board as equivalent to a reduction of speed of one mile per hour. The tide was about slack when starting, but towards the close was ahead. The speed of the vessel in smooth water and a calm, would therefore be 11 statute miles per hour. Mean revolutions of the screw per minute, 31.

With the initial pitch of the screw 40 feet, the slip would be as follows:—

$$\begin{array}{rll} 40 \times 31 \times 60 = 74{,}400 & \text{feet per hour} & = \text{speed of screw.} \\ 5{,}280 \times 11 = 58{,}080 & \text{„} & = \text{speed of vessel.} \\ \hline 16{,}320 & \text{„} & = \text{slip of screw.} \end{array}$$

or 21·935 per cent.

With the final pitch of the screw 45 feet, the slip would be as follows :—

$$\begin{array}{rll} 45 \times 31 \times 60 = 83{,}700 & \text{feet per hour} & = \text{speed of screw.} \\ 5{,}280 \times 11 = 58{,}080 & \text{„} & = \text{speed of vessel.} \\ \hline 25{,}620 & \text{„} & = \text{slip of screw.} \end{array}$$

or 30·609 per cent.

$$\text{The mean slip would therefore be } \frac{21{\cdot}935 + 30{\cdot}609}{2} = 26{\cdot}27 \text{ per cent.}$$

The mean effective steam pressure on the pistons, by indicator diagrams taken from top and bottom of each cylinder, was 16·29 pounds per square inch; the horse power developed by the engines would therefore be as follows :—

$$\frac{3067{\cdot}9 \times 16{\cdot}29 \times 4\frac{1}{6} \times (31 \times 2)}{33{,}000} = 782{\cdot}45$$

A dynamometer was fitted to the screw shaft, and gave a mean thrust of $12{,}815\frac{1}{2}$ pounds; the power exerted in propelling the vessel would therefore be

$$\frac{12815\frac{1}{2} \times 968 \text{ (speed of vessel in feet per minute)}}{33{,}000} = 375{\cdot}92 \text{ horses.}$$

If we now estimate the power required to work the engines, overcome the load on the air pump, &c., at two pounds per square inch of steam piston, an estimation that will probably vary but little from the truth, we shall have 96·06 horse power absorbed in working the engines alone.

Taking from Morin's experiments, the friction of the load at $7\frac{1}{2}$ per cent. of the power applied, and considering the power applied to be that developed by the engines, minus that absorbed in working the engines, we have for the power absorbed in the friction of the load 51·48 horses.

Collecting the above, we have the following for the disposition of the power in the *San Jacinto*:—

Slip of the screw......	26·27	per cent. or	205·55	horse power.
Propelling the vessel	48·04	„	375·92	„
Working the engines	12·28	„	96·06	„
Friction of the load...	6·58	„	51·48	„
Leaving to be absorbed in friction of the screw surface on the water, and the direct resistance of the edges of the blades, &c.	6·83	„	53·44	„
	100·00		782·45	

From the above table it will be perceived that the total losses of power by the screw were 26·27 per cent. of the total power developed by the engines in slip, and 6·83 per cent. in the friction of the screw surface in the water, &c., making 33·1 per cent.

It may be supposed that the slip of the *San Jacinto's* screw was too great for the best economical effect, and that if greater surface had been given to it, a better result would have followed. This opinion, though plausible, is not sustained by experiment.

The best proportioned screws, ascertained from a trial of many, for giving the highest speeds of vessels, were found in the small experimental vessels, *Archimedes* and *Dwarf*, which have slips of 25 and 30½ per cent. The screw giving the highest result in the experimental vessel, *Napoleon*, had also a slip of 25 per cent., which was likewise about the slip of the screw giving the best result in the *Rattler*.

(To be continued.)

CORRESPONDENCE.

THOUGHTS ON HEAT.

To the Editor of the Artizan.

Sir,—On reading over some of the last numbers of the *Artizan*, "Thoughts on Heat," by J. M., attracted my attention, and as I saw that his propositions were considered a puzzle by some of your correspondents, I set to work to find it out, but instead of there being any puzzle in the matter, I believe J.M. to be simply wrong. In the September number of the *Artizan* he states, that an enormous quantity of heat, 381,600°, becomes sensible when water is converted into steam. Sensible heat he afterwards defines to mean, the space multiplied by the temperature of these 381,600°; he considers that 380,400° (being the difference between 381,600° and 1,200) had been latent in the water. Unfortunately for his theory, however, he completely overlooks the conditions under which one volume of water becomes 1,800 volumes of steam.

These are, in the first place, that a certain quantity of heat be applied to the water; and secondly, that the space into which the steam passes be at the temperature of 212°, otherwise the steam cannot be formed. So that the 381,600° of sensible heat must exist before there is any steam formed.

The only result deducible from his "Thoughts" in the December number is, that it requires 236 times as much heat to raise 1,800 cubic feet of water to the boiling point from 62°, as it does to convert one cubic foot of water at the same temperature, into steam. In other words, that a boiler capable of converting one cubic foot of water per minute, at the temperature of 62° into steam, will require 236 minutes to raise 1,800 cubic feet of water to the boiling point from the same temperature. A notable discovery truly!

I remain, yours truly,

Feb. 11, 1852. D. J. W.

SMOKE CONSUMING FURNACES.

To the Editor of the Artizan.

Sir,—The fire-grate to which you have referred in several of your journals, under the name of "Juckes' Fire-grate," is in reality the invention of Mr. John George Bodmer, and was claimed by him in a patent dated May, 1834. I am quite prepared to prove the correctness of this assertion, and I may add that the question whether Mr. Juckes had infringed Mr. Bodmer's patent was decided against Mr. Juckes, by arbitration, some years ago.

There is very little doubt that Mr. Bodmer was the first who insisted upon the necessity of machine firing, and contrived proper apparatus to effect the purpose, although his ideas upon this point were completely at variance with those of one of the most eminent engineers in Manchester.

Mr. Bodmer has since made many and important improvements upon his first invention, by which he is not only enabled to spread the coals over the bars in the most regular and uniform manner, and at any suitable speed and depth, but also to keep the fire-bars perfectly free from clinkers, to render stoking and the opening of the fire-door quite unnecessary, and to preserve the bars from the injurious effects of over-heating.

Mr. Bodmer is also the inventor and patentee (under the above-mentioned patent) of a compensating slide valve, consisting of a piston placed opposite to, and connected by links with the valve, and the size of which piston is so adjusted as to counterbalance the pressure upon the slide valve to any desirable extent. I am induced to make this observation because I find that the invention has been repeated at least four times.

If you could find space for this communication in the next number of the *Artizan*, you would much oblige,

Your obedient servant,

London, Feb. 12, 1852. C.

REVIEWS.

A Treatise on the Marine Boilers of the United States. By B. H. Bartol, Engineer. Royal 8vo. pp. 143. Philadelphia, U. S. Barnard and Sons.

The title of this book is a misnomer. It should have been "Comparative Dimensions of the Hulls and Machinery of Sixty-four American Steamers, with drawings of the Boilers," which would have given a better idea of its contents. The *data* given are nearly the same as those of the *Pioneer*, at another page, with sketches of the boilers drawn to an uniform scale of $\frac{3}{16}$ inch to a foot, in addition. The consumption of fuel is also given, and the evaporative economy of the boilers is also calculated, although, as the author frankly states, this only gives a rough comparative test, as, for want of more minute information, he has assumed the pressure of steam to be the same in both boiler and cylinder, and has thrown out the loss of steam at each end of the cylinder, and the loss sustained by blowing out the boilers. We do not know whether we are right in supposing that the dimensions published in the *Artizan* have given Mr. Bartol the hint, but we imagine so, and we will, therefore, take leave to suggest to him that, in a second edition, the following *data* would add very much to the value of his labours. First—Indicator diagrams off the engines. Secondly—The speed of the vessel in still water with a given draft of water; and, thirdly, the area of the immersed section of the vessel. On a future occasion we will discuss the merits of the boilers here figured. To the marine engineer and shipbuilder it will prove a very useful work of reference, and we can only regret that the high price put upon it by the importers will inevitably prejudice the sale of it in this country.

A Treatise on the Slide Rule, with description of Lalanne's Glass Slide Rule. By the Rev. W. Elliott, M.A. Sold by W. Elliott and Sons, 56, Strand.

Those who have faith in slide-rule calculations will feel much indebted to Mr. Elliott for his introduction of this ingenious invention, which is composed of glazed paper and pasteboard, and has the scales protected by glass. An immense number of gauge points are given, and the scales being printed off copper plate, are very superior in fineness and distinctness to the ordinary box-wood rule. We must confess, however, that for own part, we prefer a table of figures and a little pencil and paper work to all the refinements of the calculating machine, at least for the purposes of every-day life. The treatise, accompanying the rule, appears likely to be useful, apart from the purpose for which it is specially designed.

The Machinery of the Nineteenth Century. By G. D. Dempsey, C.E. London: Atchley and Co.

The melancholy exhibition of machinery in the Illustrated Catalogue has, we have no doubt, spurred on the publishers of this work to retrieve the national reputation. They state "that the objects aimed at are to

preserve a worthy record of the admirable machinery by which the manufacturing arts are now facilitated in this country, and to embody a correct description of the splendid specimens shown at the Exhibition of the Works of Industry of All Nations." The plates of the present number are—two of Bishopp's Patent Disc Engine, as constructed by Messrs. Rennie, for Messrs. Marshall and Co., of Leeds; one of Mr. Clayton's Patent Brick, Tile, and Pipe Machine; one of Mr. Fairbairn's Patent Wrought Iron Tubular Crane; and one of Clymer and Dixon's Patent Columbian Printing Press. We perceive it is proposed to publish the plates with the text also in French, which is a good idea. The plates are very clearly delineated in lithograph, by Messrs. Martin and Hood, and the text, though small in quantity, is up to the mark in quality.

Exhibition Lectures at the Society of Arts.

We are glad to see the Society of Arts taking up the position justly due to it from its intimate connection with the Great Exhibition. The present series of lectures, suggested by Prince Albert, are so interesting that we regret that we cannot give them entire. As it is we must content ourselves with a few selections from the more prominent topics.

Professor Owen gives the following account of a comparatively new branch of art, which promises to prove of great importance:—

Gelatines.—Such productions as coral, shell, and pearl, are naturally attractive by their intrinsic beauty or rarity. But the most refuse and uninviting, and seemingly most worthless parts of animal bodies, are turned to uses of the most unexpected kind by the inventive skill and science of man.

The raw materials chiefly used in manufactures derived from the gelatinous textures of animal bodies, may be divided, as regards their commercial value and application, into two kinds:—

1st. The gelatines and glues, properly so called, derived from the dissolution of certain animal tissues, and especially from the waste residue of parts of animals which have served for food, or for the operations of tanning, or for the fabrication, as from bones, of articles in imitation of ivory, or from the waste particles in the carving of ivory itself.

2nd. The cleaned and dried membranes of different species of fish, more especially of the sturgeon family (*Acipenseridæ*), preserving a peculiar texture, on which their value in the refining of fermenting liquors more especially depends; such membranes are called "isinglass."

The most remarkable progress in the economical extraction and preparation of pure gelatines and glues from the waste remnants of the skins, bones, tendons, ligaments, and other gelatinous tissues of animals, has been made in France, where the well-organized and admirably arranged establishments for the slaughter of cattle, sheep, and horses in large towns, give great and valuable facilities for the economical applications of all the waste parts of animal bodies. Among the beautiful productions of this industry, the specimens exhibited by its chief originator, M. L. F. Grenet, under No. 247, merited peculiar approbation. They included different kinds of gelatine in thin layers, adapted for the dressing of stuffs, and for gelatinous baths, in the clarification of wines which contain a sufficient quantity of tannin to precipitate the gelatine; pure and white gelatines cut into threads for the use of the confectioner: very thin white and transparent sheets called "papier glacé" or ice paper, for copying drawings; and, finally, a quantity of objects of luxury or ornaments formed of dyed, silvered, or gilt gelatines, adapted to a variety of purposes, and to the fabrication of artificial or fancy flowers. M. Grenet, who was the first to fabricate on a large scale, out of various residues of animal bodies of little value, these beautiful and diversified products, many of which previously had been derived from the more costly substance—isinglass, was deemed by the jury to merit the award of the council medal.

Many manufacturers in France have risen to great eminence in this line by following the processes of M. Grenet. H. Castelle, of Paris, exhibited (No. 107) a still more varied assortment of the modifications of gelatine, amongst which were particularly deserving of notice the very large sheets of transparent gelatine, colourless, white, of various well-defined colours, and embossed or stamped with elegant patterns.

Jacob Bell, Esq., M.P., in his lecture on pharmaceutical processes and products, gives a curious illustration of the extent to which the consumer is prejudiced by the obstacles which intervene between himself and the producer:—

An ingenious application of the science of chemistry consists in the manufacture of artificial essences of pears, pine-apples, and other fruits. A few specimens which I have received from Mr. Piper, of Upper Winchester Street, Pentonville, are on the table. In the concentrated form, the smell is rather acrid, but when diluted, the resemblance to the fruit is recognised. The best imitations are the pine-apple and the jargonelle pear; the green gage, apricot, black currant, and mulberry, when properly mixed, are fair imitations. They are quite innocuous in the proportions used, namely, a drop or half a drop to the ounce. I have been informed, that some of the ices furnished in the Great Exhibition were flavoured with these essences. The introduction of these preparations originated, I believe, in the discovery of the fact, that the peculiar flavour of "pine-apple rum" was due to butyric ether, which has since been obtained from the fruit itself. Further experiments led to the discovery of other artificial essences.

Here is a series of specimens of scammony from the English collection. No. 1 is pure; the others are more or less adulterated, down to No. 5, which is not worthy of the name of scammony. In the Turkish collection, where we might have expected to find scammony unusually fine, No. 1 is about on a par with No. 3 in those above mentioned, and No. 5 would not be recognised as scammony except by the label on the bottle. It is only within a few years that pure scammony has been known in England, and its introduction arose from the circumstance of several samples of scammony being analysed, and found to be adulterated (chiefly with starch and chalk) to an extent varying from about 15 to 60 per cent. The fact being reported to the merchant abroad, he replied, that he made it to suit the demand, and mixed it according to the price. He said he would send it pure if desired, but it would be dear in proportion. From that time, "virgin scammony," as it is called, has been in the English market, but it has not yet found its way to the continent of Europe. Several foreign professors, lecturers on *materia medica*, and possessors of extensive museums, had never seen pure scammony until they saw it at the Great Exhibition, and were glad to obtain a few ounces as a specimen, to take home with them as a curiosity. Similar remarks may be made with regard to opium, of which we had specimens from various localities. This is a drug which, like many others, is adulterated to suit the demand.

NOTES ON RECENT ENGLISH PATENTS.

Levi Russell, of New York, engineer, *for certain new and useful improvements in the means of sustaining travelling carriages and other vehicles, which improvements are applicable to other like purposes.* Aug. 5th, 1851.

These improved springs consist of pieces of wood of the usual shape, cut transversely on the convex side in a number of places, the spaces thus formed being filled up with metal, wood, or yielding material, as may be required; or the wood may be held together by a plate of metal, bolted on to the convex side of the wooden spring.

E. Deeley and R. M. Deeley, Stourbridge, glass manufacturers, *for certain improvements in the construction of furnaces for the manufacture of glass.* August 6th, 1851.

The object of these improvements is to cause the flame of the furnace to play directly on the sides of the glass melting pots. With this view, the bars are set at an angle of about 45°. The bridge at the back of the bars being also inclined, the flame rises freely round the sides of the pot.

Alphonse de Normandy, of Judd-street, gentleman, and Richard Fell, engineer, *for improved methods of obtaining fresh water from salt water, and of concentrating sulphuric acid.* August 7th, 1851.

We see but little new in this patent. The distilling apparatus consists of a series of chambers communicating with each other, and placed one above the other in a cylinder heated by steam. The salt water is admitted at the top, and makes its way down to the bottom, being distilled in its passage. Atmospheric air is admitted to aerate the distilled water. The same principle is applied to the sulphuric acid still, the cylinder being placed horizontally, and

formed of platinum, glass, porcelain, or other substance capable of resisting the acid.

L. Bunn, of Walbrook, merchant, *for improvements in the manufacture of Kamptulicon.* August 7th, 1851.

Kamptulicon, as will be found by referring to the early volumes of the *Artizan*, is composed of cork-dust and caoutchouc, and promised to be a very useful material as a substitute for floor cloth, for deadening concussion, &c., but its introduction has been retarded by circumstances not dependent on its merits. The first improvement consists in combining with it, sheet metal or wire gauze, to render it more durable. The second, in forming a coloured article by dyeing the cork which forms one of the materials. The third, in making Mosaic patterns by combining coloured strips, in any required pattern, the mass so formed being then cut transversely into layers, which may be used by themselves, or combined with the ordinary material.

Stephen Moulton, of Bradford, Wilts, India rubber manufacturer, *for certain improvements in the preparation of gutta percha and caoutchouc, and in the application thereof.* August 14th, 1851.

The patentee claims combining with gutta percha, or with a mixture of gutta percha and caoutchouc, a mixture of hyposulphite or sulphite of lead or zinc, and artificial sulphuret of lead or zinc, which when submitted to a high temperature produces a compound, which the inventor calls "cured" gutta percha, and which remains unaffected by changes of temperature and various solvents, the operation resembling the vulcanizing of India rubber. It also gives to the gutta percha a degree of elasticity which, in its native state, it does not possess. The patentee also proposes to use Paris white or chalk mixed with the above ingredients.

Thomas Skinner, of Sheffield, *for improvements in producing ornamental surfaces on metal, and other materials.* August 14th, 1851.

The ornamenting process consists in transferring to the object the design in ink from a copper plate on which it has first been engraved. The ground of the pattern is then stopped out with varnish, and the ink pattern removed with turpentine, leaving the pattern traced on the unprotected metal. This is then bitten in with dilute acid, and by the electrotype process, gold or silver is deposited on the pattern. The process may be transposed to form a pattern in relief. Bone and ivory may be ornamented by transferring the pattern, and embuing the etched lines with suitable dyes or composition. This process promises to be a valuable contribution to the ornamental arts.

RECENT AMERICAN PATENTS.

For an *improvement in hand stamps;* Stephen P. Ruggles, Boston, Massachusetts, September 23.

"The nature of my invention consists in so constructing a hand stamp, that by moving it in the arc of a circle, such as would be naturally made by the rising and falling of the arm, it will come down upon the paper at all points of its surface, although it may strike at an angle with the plane upon which the material to be stamped is placed, and at all times make a fair and perfect impression, whether moved in a perpendicular or oblique line to the same."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, securing the plate of a hand stamp to the shank or handle, by means of a universal ball-and-socket or other joint, so as to allow the stamp to make a fair impression at whatever angle it may strike the material to be stamped, as herein fully set forth and explained."

For an *improvement in instruments for the cure of stammering;* Robert Bates, Philadelphia, Pennsylvania, September 30.

"The nature of my invention consists in the employment of a tube in the mouth, for the passage of air from the mouth, when the muscles that close the orifice of the mouth and stop the egress of air, in speaking, are suddenly contracted by spasmodic action; and in the employment of a strap around the throat, provided with a spring pad, regulated by a screw, which pad presses against the throat, and keeps the glottis or larynx of the throat open, thereby allowing a free passage of air through the throat and mouth, from the lungs; the arrest of which air, by the spasmodic action of the throat and mouth, causes stammering, and its escape by means of my instrument cures the spasmodic action, and consequently cures stammering."

Claim.—"Having thus fully described my instruments for the cure of stammering, and their application and method of use, what I claim as my invention is, 1st, the employment of a tube in the mouth, which will admit of speaking, and of the passage of air, when either the tongue or lips would prevent the passage of air, substantially as herein above set forth.

"2nd, The employment of the adjustable spring pad, substantially as herein above set forth.

"3rd, The joint employment of the mouth tube and the adjustable spring pad, at the same time curing the guttural, lingual, and labial disease of stammering, substantially as herein above set forth."

For an *improvement in fountain pens;* Newell A. Prince, New Gloucester, Maine, September 30.

Claim.—"What I claim as my invention is, the improvement of the hollow, flexible, and long extension of the reservoir or tube, to extend up and be secured to the arm of the writer, substantially in manner and for the purpose as specified."

For an *improvement in shields for valves;* Alexander Jimason, Parkesburgh, Pennsylvania, September 30.

"This improvement consists in furnishing the valve with a shield, to protect it from the action and reaction of the fluid which surrounds it, when in operation, thus preventing, in a great measure, the rapid destruction of the valves, valve-seats, and chambers, in which the valve is generally made to work."

Claim.—"What I claim is, surrounding the valve by a shield, constructed substantially in the manner as herein described and set forth, and fitting closely enough to regulate the ingress and egress of the water or steam, to such a degree as to prevent the slamming of the valve, in opening and closing."

For an *improvement in tanning;* Nathaniel C. Towle, Washington, D.C., October 7.

Claim.—"What I claim as my invention or discovery as a new and useful improvement is, the use of arsenic or arseneous acid, substantially in the manner and for the purposes herein set forth. The peculiar properties of arsenic, by which it tends to suspend the natural tendency of the animal fibre to decomposition upon the extinction of animal life, are well known, and of course they are not patentable; but their application to the processes of tanning, and otherwise preparing skins and hides for useful purposes, by which they are rendered stronger and more durable, is believed not to have been heretofore known and used.

"I do not, therefore, intend to limit my claim to any particular mode or period of using the article; but I shall apply it in such form or in such strength of solution as the nature of the case may require, to effect the objects named. Workmen should guard against the absorption of the poisonous qualities of the arsenic, while immersing or handling the skins in the liquor, by using tools or wearing India-rubber gloves. After the skins are taken out of the liquor and rinsed thoroughly, the danger ceases."

For an *improvement in devices for sowing in a seed planter;* W. P. Clements, Ellerslie, Georgia, October 7

"The nature of my invention consists in the novel manner of availing of the natural motion of the shoulders of a horse or other animal, while walking or propelling a drill, to operate the seed dischargers, so that at each step of the animal, its shoulder blades shall act alternately upon levers, reciprocating the arms, working inside the hopper, so as to discharge the desired quantity of seed, without the aid of wheels, cams, or any other machinery than the simple arrangement represented in the drawings, which is not more complicated or more liable to get out of order than an ordinary plough.

Claim.—"What I claim as new is, the novel manner of discharging the seed by the natural motion of the horse or animal, while in the act of walking and propelling the drill, without the aid of wheels, with the arrangement of levers, arms, &c. for discharging the seed, or their equivalents, operating in the manner and for the purpose herein fully set forth and represented."

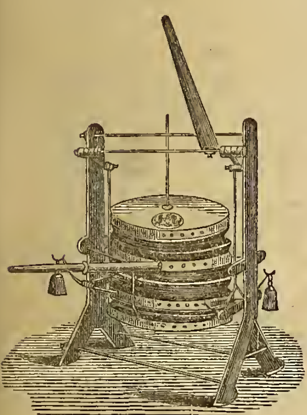
For an *improvement in apparatus for warming air and water for dwellings;* Le Graud C. St. John, Buffalo, New York, Ooctober 7.

"The nature of my invention consists in making a fire-proof apartment, with either circular or rectangular sides, from the lowest extremity of the

house to the roof. At the bottom of this apartment are furnaces, the heat of which enters the apartment. The pipes of stoves enter the same apartment, and wind around its sides to a chimney near the roof. In cold weather the heat is taken from this apartment in pipes to warm the house, and in warm weather it is turned out of the house, through the chimney. Any requisite degree of heat may be made without waste of fuel. If the fire from the cooking stove, which passes through the pipe, does not warm the house sufficiently, the heat of one or more furnaces may be added. The top of the apartment has a bowl in the roof, from which the water may pass down in a pipe in the apartment to a reservoir, or pass into a structure, filling cisterns opposite the different stories, and the surplus then pass, by pipes, into a reservoir, from whence it may be re-elevated for the supply of upper rooms."

Claim.—"What I claim as my invention is, the construction of a fire-proof apartment in houses, extending from the lowest extremity of the house to the roof, with furnaces at the bottom ; the smoke pipes of other fires, entering it, and winding along its walls to a chimney at the top, and with openings to let the heat in the apartment into the house or up the chimney; and also for the construction of cisterns within the fire-proof apartment, with the pipes, as above described."

NOVELTIES.



WRIGHT'S IMPROVED CIRCULAR BELLOWS.—Messrs. Wright and Co. have submitted to us specimens of their improved circular bellows, of which the accompanying engraving will give a good idea. They are very compact and powerful, being double-acting, whilst from their portability they are well calculated for general use, the colonies, &c.

NEW AMERICAN RUDDER.—A new screw steamer, called the *South Carolina*, of 1,300 tons register and 600 horse power, has been launched at New York. She is destined as the pioneer of the projected line between Charleston and Liverpool. She has three decks, is full ship-rigged, and built in the most substantial manner. Her engines were built at the West Point foundry. Her rudder is of peculiar construction ; it is a balanced one, the rudder-post forming stern-post and rudder-post, and is held by an iron knee projecting under the propeller at the bottom, and by an iron-brace just over the propeller ; is in shape like the paddle of an Indian canoe, and revolves completely round, fitting into the bottom of the arms of the propeller, the after part of the rudder being a little in excess of the forward part. It always accommodates itself to the motion of the ship, and in going astern, the after part of the rudder takes the place of the forward part, when the ship would be going a-head. It is geared with a cog and pinion wheel upon the head of the rudder-post. The whole apparatus is said to be simple in its construction and arrangements. The size is 13 feet by 2 feet 3 inches, being from one foot in breadth at the extremities, to three feet at the centre of the rudder, and directly opposite the propeller shaft.

GILES' PYRACOUST.—This is intended to give an alarm in case of burglary or Fire. In the former case, a bolt is attached to the door or windows, which, on being moved, presses on and breaks a glass globule containing sulphuric acid, which ignites a fulminating mixture placed in a receiver beneath. This appears a round-about way of doing the thing. In a simple invention previously described in our pages, the globule is the detonating ball, and the same end is at once attained. The fire alarm is on a similar principle, but the acid is set free by the melting of a wax cover on the mouth of the globule.

HODGES' SAFETY KETTLES, are a praiseworthy attempt to improve this useful appendage to the fire-side. The nose of the spout is closed by a cover, which can be opened by depressing a button on the handle. The cover, instead of being under is behind the handle, and easily accessible, and the steam is allowed to blow off through an orifice at the back of the handle. No one can deny that these are great improvements, but the force of prejudice is strong—very strong.

PRISMATIC GAS REFRACTORS.—Mr. Boggett has recently patented an arrangement for increasing the light given out by a gas burner, by arranging around it two or more vertical gas prisms, each of which multiplies the flame by three, according to the position of the spectator.

OIL FOR LUBRICATING MACHINERY.—Boil 500lbs of American potash in 125 gallons of water in an iron vessel, by means of steam, or in any other convenient way, until the potash is dissolved ; after which add a sufficient quantity of water to supply the loss caused by evaporation. Let stand for twelve hours, and then draw off the clear solution for use. Next, place in a suitable iron vessel four tons of southern oil and one ton of cocoa-nut oil or lard oil, and to it gradually add, with constant agitation, the potash solution made as above stated; continue the agitation for two hours after the addition of the potash; then let the whole stand for twenty-four hours, at the end of which time draw off the oil from the dregs, and heat it by means of free steam in a wooden vessel with half its weight of water ; after standing twelve hours, draw off the water, and repeat the operation a second, or even a third time if necessary. Should the southern oil employed contain a large quantity of gummy matter, a larger proportion of cocoa-nut oil or lard oil should be used.—*Chemical Record.*

COD LIVER OIL.—The official examiner of the American patent office, states that "a large quantity of sperm and whale oil is now consumed to manufacture the celebrated cod liver oil, which, as now sold, is about one-third part cod liver and other fish liver oils, and the remainder fish and whale oil."

BLUNDELL'S PATENT ROAD-SWEEPING MACHINE.—Whitworth's street-sweeping machines have not, we find, been pecuniarily successful in Manchester, and we are very doubtful whether the present modification will be more fortunate. It has the defect of not raising the mud into a receiver, but merely lays it on one side. It consists of a cart, carrying a rotating brush, placed diagonally at about 45° with the line of motion. The mud is thus laid in a continuous line by the side of the track of the machine. Provision is made for raising and lowering the revolving brush to suit the road. One of Mr. Crosskill's manufacture has been tried in Hull, and report speaks favourably of its performance.

LIST OF ENGLISH PATENTS.

FROM 23RD JANUARY, TO 14TH FEBRUARY 1852.

Six months allowed for enrolment, unless otherwise expressed.

Thomas Richardson, of Newcastle-upon-Tyne, for improvements in the manufacture of magnesia and some of its salts. January 23.

George Stacey, of Uxbridge, Middlesex, machinist, for certain improvements in machinery for reaping, mowing, and delivering dry or green crops. January 24.

William Pidding, of the Strand, Middlesex, gentleman, for improvements in the manufacture, preparation, and combination of materials or substances for the production of fuel, and for other useful purposes to which natural coal can be applied. January 24.

Joseph Jones, of Bilston, Stafford, furnace builder, for an improvement or improvements in furnaces used in the manufacture of iron. January 24.

Richard Ford Sturges, of Birmingham, Warwick, manufacturer, for an improved method or improved methods of ornamenting metallic surfaces. January 24.

John Hinks, of Birmingham, manufacturer, and Eugene Nicolle, of Birmingham aforesaid, civil engineer, for certain improved machinery to be used in the manufacture of nails, rivets, bolts or pins, and screw-blanks. January 24.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in lithographic, typographic, and other printing-presses, which improvements are also applicable, with certain modifications, to extracting saccharine, oleagineous, and other matters, and to compressing in general. (Being a communication.) January 24.

James Gathercole, of Eltham, Kent, envelope manufacturer, for improvements in the manufacture and ornamenting of envelopes, parts of which improvements are applicable to other descriptions of stationery; and in the machinery, apparatus, or means to be used therein. January 24.

Arad Woodworth, and Samuel Mower, of Massachusetts, United States, for certain new and useful improvements in machinery for manufacturing bricks, tiles, or other articles of a similar character. January 24.

Alfred Richard Corpe, of Kensington, Middlesex, gentleman, for improvements in trouser-strap fasteners. January 24.

George Kent, of the Strand, for certain improvements in apparatus for sifting cinders, and in apparatus for cleaning knives. January 24.

Joseph Maudslay, of the firm of Maudslay, Sons, and Field, of Lambeth, Surrey, engineers, for improvements in steam engines, which are also applicable, wholly or in part, to pumps and other motive machines. January 26.

Edward Simons, of Birmingham, tallow-chandler, for certain improvements in lighting. January 27.

William Brindley, of Queenhithe, for improvements in the manufacture of flocked fabrics, and in the manufacture of buttons. January 27.

William Dray, of Swan-lane, Upper Thames-street, London, agricultural implement maker, for improvements in reaping machines. (Being a communication.) January 27.

George Duncan, of New North-road, Hoxton, and Arthur Hutton, of Herbert-street, New North-road, Hoxton, for improvements in the manufacture of casks. January 27.

Nelson Smith, of New York, United States, gentleman, for improvements in the construction of violins, and other similar stringed musical instruments. (Being a communication.) January 27.

Jean Benjamin Coquatrix, of Lyons, France, merchant, for improved apparatus for lubricating machinery. January 27.

James Joseph Brunet, of the Canal Iron-works, Poplar, Middlesex, engineer, for certain improved combinations of materials in ship-building. (Being a communication.) Jan. 27.

Alexander Mills Dix, of Salford, brewer, for certain improvements in the method of ventilating apartments or buildings, and in the apparatus connected therewith. January 27.

Thomas Lambert, of Hampstead-road, Middlesex, piano-forte manufacturer, for certain improvements in piano-fortes. January 27.

Julian Bernard, of Guildford-street, Russell-square, Middlesex, gentleman, for improvements in the manufacture or production of boots and shoes, and in materials, machinery, and apparatus connected therewith. January 27.

Joseph Vincent Melchior Raymondi, of Paris, France, machinist, for certain improved statistic and descriptive maps. January 27.

Isaac Lewis Pulvermacher, of Vienna, engineer, for improvements in galvano-electric, magneto-electric, and electro-magnetic apparatus, and in the application thereof to lighting, telegraphic, and motive purposes. January 29.

François Jules Manceaux, of Paris, France, gun-manufacturer, for improvements in firearms, and in instruments and apparatus used in connection therewith. January 29.

Isham Baggs, of Liverpool-street, Middlesex, electrical engineer, for improvements in crushing gold quartz and metallic ores. January 29.

Joseph Maximilian Ritter von Winiwarter, of Surrey-street, Strand, Middlesex, Doctor of Law, for certain improvements in the locks of fire-arms and cannon, and in gun-matches, or in the mode of igniting gunpowder used in guns, and in machinery for manufacturing the same. January 20.

William Smith, of Kettering, Northampton, agricultural implement maker, for improvements in apparatus for cutting or breaking lump sugar, and other vegetable substances. January 29.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of pigments or paints. (Being a communication.) Jan. 29.

Edward Highton, of Clarence villa, Regent's-park, Middlesex, civil engineer, for improvements in electric telegraphs. January 29.

William Longmaid, of Beaumont-square, Middlesex, gentleman, for improvements in obtaining gold. January 30.

Owen Williams, of Stratford, Essex, engineer, for improvements in preparing compositions to be used in railway and other structures, in substitution of iron, wood, and stone. (Being a communication.) January 31.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in multiplying motion applicable to steam engines, saw-mills, and other machinery in which an increase of velocity is required. (Being a communication.) January 31.

Martyn John Roberts, of Woodbank, Gerrard's-cross, Bucks, esq., for improvements in agricultural instruments. January 31.

Alexander Hediard, of 25, Rue Taitbout, Paris, France, gentleman, for improvements in propelling and navigating ships, boats, and vessels, by steam and other motive power. January 31.

Joseph Haythorne Reed, late of the 17th Lancers, Harrow-road, Middlesex, gentleman, for improvements in propelling vessels. January 31.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of Fleet-street, London, patent agents, for improvements in the purification and decoloration of oils, and in the apparatus employed therein. (Being a communication.) January 31.

William Squire, of High-holborn, late of George-street, Euston-square, both in Middlesex, pianoforte-maker, for improvements in the construction of pianofortes. January 31.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for weaving coach-lace, Brussels tapestry, and velvet carpeting, and other piled fabrics. (Being a communication.) January 31.

Frederick Philip Thompson, of Waterworks-chambers, Orange-street, Trafalgar-square, engineer and surveyor, for improvements in filtering and preserving water. February 2.

George Spencer, of Lacey-terrace, Islington, engineer, for improvements in the springs of railway carriages, trucks, and waggons. February 2.

Samuel Cunliffe Lister and James Ambler, both of Manningham, in the parish of Bradford, York, manufacturers, for improvements in preparing and combing wool and other fibrous materials. February 2.

Emanuel Charles Theodore Croutelle, manufacturer, of Rheims, for certain improvements in machinery or apparatus for preparing woollen threads and other filaments. February 3.

Robert Hesketh, of Wimpole-street, Marylebone, Middlesex, for improvements in apparatus for reflecting light into rooms and other parts of buildings and places. February 3.

Peter Claussen, of Gresham-street, London, gentleman, for improvements in the manufacture of saline and metallic compounds. February 3.

George Torr, of the Chemical-works, Frimley's-lane, Rotherhithe, animal charcoal-burner, for improvements in reburning animal charcoal. February 3.

John Feather, of Keighley, York, worsted spinner and manufacturer, and Jeremiah Driver, of the same place, iron and brass founder, for certain improvements in screws. February 9; two months.

Auguste Neuberger, of Rue Vivienne, Paris, France, lamp manufacturer, for certain improvements in lamps. February 9.

William Beckett Johnson, of Manchester, Lancashire, manager for Messrs. Ormerod and Son, engineers and ironfounders, for improvements in railways, and in apparatus for generating steam. February 9.

Sanders Trotman, of Clarendon-road, Middlesex, civil engineer, for improvements in fountains. February 9.

John Dennison, of the firm of John Dennison and Son, of Halifax, York, and David Peel, of the same place, manufacturers, for an improved lubricating compound. February 9.

Ralph Errington Ridley, of Hexham, Northumberland, tanner, for improvements in cutting and reaping machines. February 9.

Martyn John Roberts, of Woodbank, Gerrard's-cross, Bucks, esq., for improvements in galvanic batteries, and in obtaining chemical products therefrom. February 10.

John Smith Hutton, of Bolton-le-Moors, Lancashire, bleacher, and Joseph Musgrave, of the same place, engineer, for a certain improvement or improvements in apparatus used in the bleaching of yarns and goods. February 12.

Christian Schiele, of Oldham, Lancashire, machinist, for certain improvements in obtaining and applying motive power. February 12.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the heddles or harness of looms for weaving, and in the machinery for producing the same. (Being a communication.) February 12.

John Stephens, of Kennington, Surrey, esq., for improvements in obtaining and applying motive power. February 12.

John Mollady, junior, of Denton, Lancashire, hat-manufacturer, for certain improvements in machinery or apparatus for manufacturing hats or caps. February 12.

Charles Louis Barbe, of Mulhouse, France, for improvements in the reproducing of drawings, and in the mode of obtaining designs, to be principally used in the engraving surfaces for printing fabrics. February 12.

Edmund Morewood, of Enfield, Middlesex, and George Rogers, of the same place, for improvements in the manufacture, shaping, and coating of metals, and in the means of applying heat. February 13.

Annet Gervoy, of Lyons, France, director of the Lyons Railway, for means to prolong the durability of the rails on railways. February 13.

Hermann Turck, of Broad-street-buildings, London, merchant, for improvements in the manufacture of rosin-oil. (Being a communication.) February 14.

Arthur Wellington Callen, of Peckham, Surrey, gentleman, and John Onions, of Southwark, in the same county, engineer and ironfounder, for improvements in the manufacture of certain parts of machinery used in paper-making, and certain parts of railways, railway, and other carriages. February 14.

LIST OF SCOTCH PATENTS.

From 26th of December, 1851, to the 16th of January, 1852.

James Macnee, of Glasgow, Lanark, North Britain, merchant, for improvements in the manufacture or production of ornamental fabrics. December 26.

Jean Antoine Farina, Paris, proprietor, for a process for manufacturing paper from a certain material. December 26.

Francis Hastings Greenstreet, of Albany-street, Mornington-crescent, Middlesex, for improvements in coating and ornamenting zinc. December 29.

Frederick Rosenborg, Esq., of the Albany, Middlesex for improvements in the manufacture of casks, barrels, and other like articles, and the machinery employed therein. January 2.

James Aikman, of Paisley, calenderer, for improvements in the treatment or finishing of textile fabrics and materials. January 6.

James Gathercole, of Eltham, envelope manufacturer, for improvements in the manufacture and ornamenting of envelopes, parts of which improvements are applicable to other descriptions of stationery, and in the machinery, apparatus, and means to be used therein. January 8.

Edwin Rose, of Manchester, engineer, for certain improvements in boilers for generating steam. January 9; four months.

Thomas Richardson, of Newcastle-upon-Tyne, for improvements in the manufacture and preparation of magnesia, and some of its salts. January 12.

James Warren, of Montague-terrace, Mile-end-road, gentleman, for improvements applicable to railways and railway carriages, and improvements in paving. January 13.

Alexander Parkes, of Birmingham, for improvements in separating silver from other metals. January 13.

Alexander Hediard, of 26, Rue Taitbout, Paris, for improvements in propelling and navigating ships, boats, and vessels, by steam, and other motive power. January 16.

LIST OF IRISH PATENTS.

From 21st of December, 1851, to the 3rd of January 1852.

Alphonse René Le Mire de Normandy, of Judd-street, Middlesex, gentleman, and Richard Fell, of the City-road, in the same county, engineer, for improved methods of obtaining fresh water from salt water, and of concentrating sulphuric acid. December 22.

Charles Watt, of Kennington, Surrey, chemist, for improvements in the decomposition of saline and other substances, and separating their component parts, or some of them, from each other; also, in the forming certain compounds or combinations of substances, and also in the separating of metals from each other, and in freeing them from impurities. December 22.

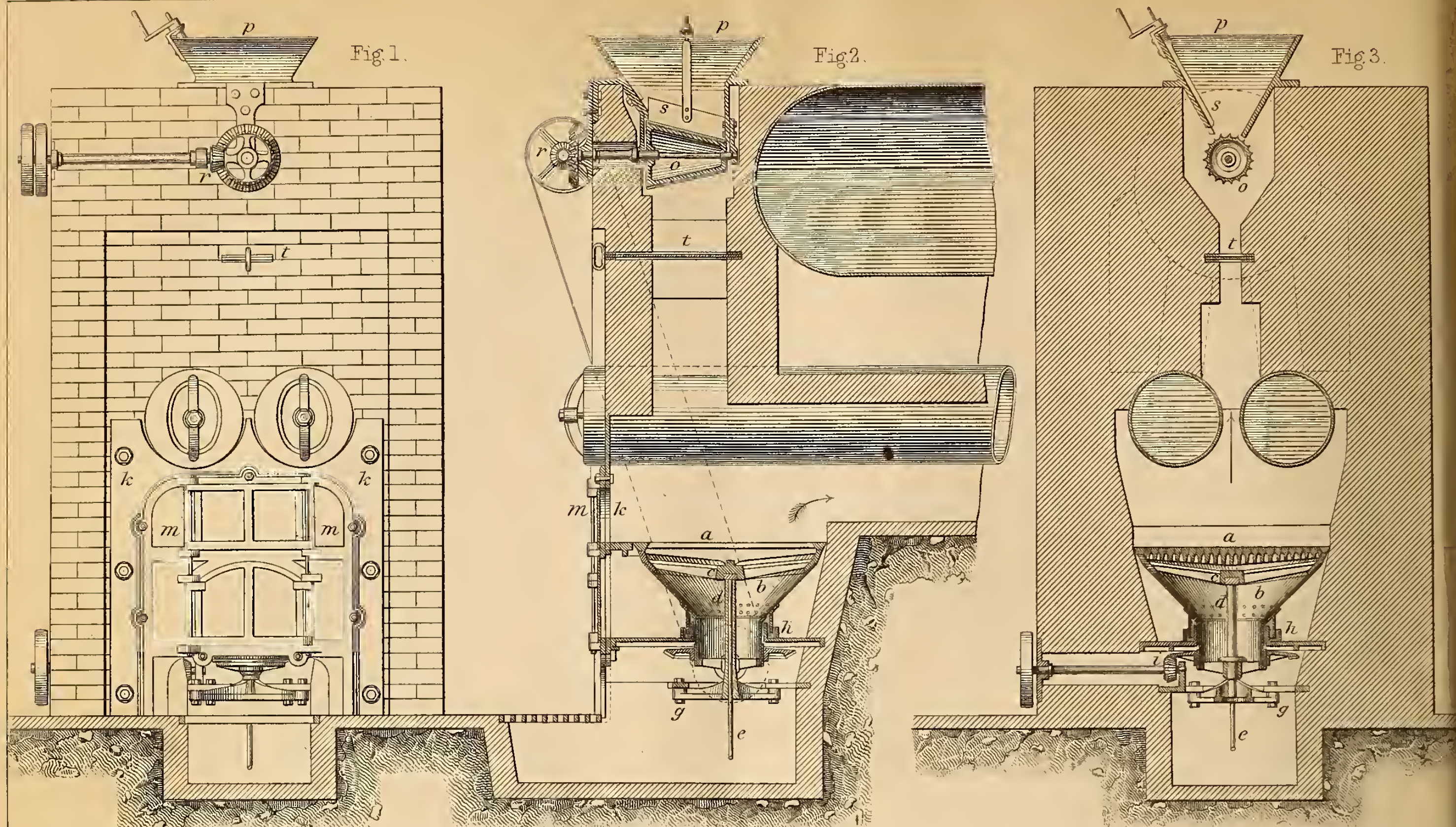
Matthew Gibson, of Wellington-terrace, Newcastle-upon-Tyne, for improvements in machinery for pulverising and preparing land. January 3.

Antoine Dominique Sisco, of Slough, for improvements in the manufacture of chairs, and in combining iron with other metal applicable to such, and other manufacture. January 3.

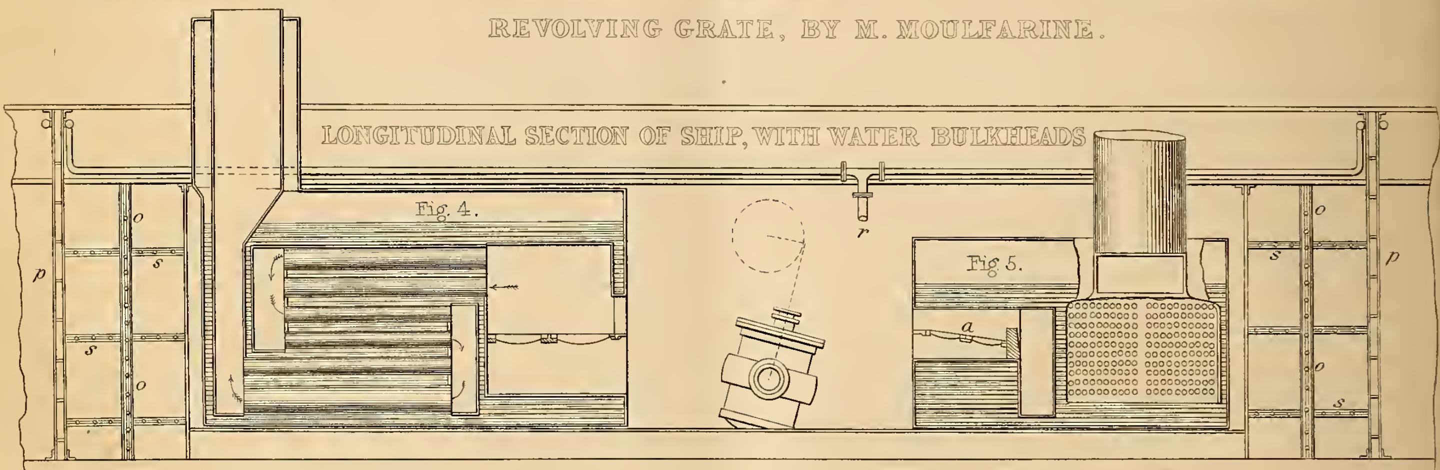
DESIGNS FOR ARTICLES OF UTILITY.

From the 22nd January, to the 18th February 1852, inclusive.

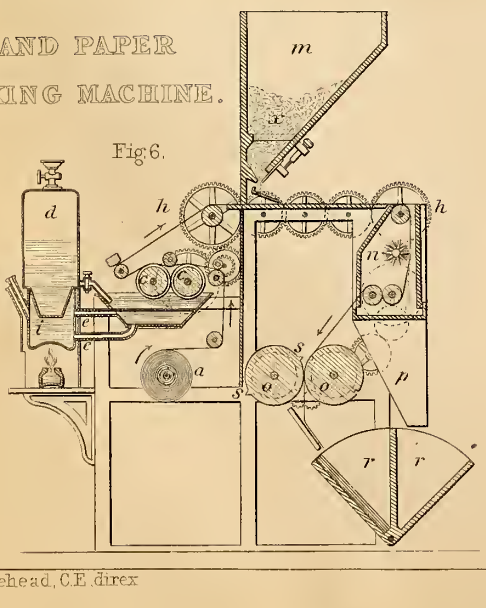
January 22, 3090, George P. Cooper, Suffolk-street, Pall-mall, "Elliptic gussett."
„ 28, 3091, W. C. Wright, South-quay, Regent's-canal Dock, "Machine for screening coals."
„ 28, 3092, Brierley and Sons, Cheapside, Halifax, "Fastening for braces, &c."
„ 29, 3093, T. Fotherby and Son, Leeds, "Setting up brush."
„ 29, 3094, J. Shaw, Southover Laves, "Dried fruit dressing machine."
„ 29, 3095, H. A. Hall, Spalding, "Pump and fire engine."
„ 30, 3096, T. H. Ryland, Birmingham, "Joint for parasol handle."
„ 30, 3097, H. Field and Son, Glasgow, "Domestic gas apparatus."
„ 30, 3098, A. Hewlett, Burlington Arcade, "Caliendrum (wig.)"
„ 31, 3099, T. Woolley, Nottingham, "Parts of the action of a piano-forte."
February 2, 3100, J. Bedington, Birmingham, "Hat and coat guard."
„ 2, 3101, J. Jacquier, Wood-street, Spitalfields, "Jacquard machine."
„ 2, 3102, Wolf and Baker, Sambrook-court, "Revolving fusee-box."
„ 3, 3103, W. Jefford and S. Turner, New Radford, Nottingham, "Improvements in twist lace brass bobbins."
„ 3, 3104, S. F. Cottam, Manchester, "Bearings for spindles of spinning, doubling, and winding machines."
„ 3, 3105, T. Smith and Sons, Birmingham, "Wick-holder and elevator for Argand lamps."
„ 4, 3106, J. H. Fiedler, Addle-street, "Travellers' expanding bag."
„ 4, 3107, M. Hyams and Co., Long-lane, "Exhibition cigar."
„ 4, 3108, J. Warner and Sons, Jewin-crescent, "High-pressure valve."
„ 5, 3109, Westley Richards, Birmingham, "Rifle sight."
„ 5, 3110, Frederick York, Augustus-street, Regent's-park, "Box knife, fork, and metal-cleaning machine."
„ 6, 3111, John McDougall, Kelso, "Cooking apparatus."
„ 6, 3112, Joseph and Thomas Todd, Cannonmills, Edinburgh, "Expanding cap."
„ 7, 3113, Edmond Fogden, East Dean, Chichester, "Manure distributor."
„ 7, 3114, John Powell, High-street, Eton, "Windsor oven."
„ 9, 3115, W. and C. Kearthland, Mill-street, Lambeth, "Frame for drying stockings and socks."
„ 10, 3116, Jamieson and Kenworthy, Ashton-under-Lyne, "Expanding or contracting 'wraith,' or comb for sizing, warping, and beaming machines."
„ 10, 3117, Kenworthy and Jamieson, Blackburn, Lancashire, "Spiral, expanding, and contracting 'wraith,' or comb for sizing, warping, and beaming machines."
„ 11, 3118, A. D. Lamb, Berwick-on-Tweed, "Gas regulator."
„ 12, 3119, M. Thompson, Plymouth. "Telescopic Slush and tallow lamp."
„ 12, 3120, W. Pink, Fareham, "Saddle strap-bar."
„ 13, 3121, J. C. Bucknill, Exminster, "Bullet mould."
„ 13, 3122, C. Smith, A. Smith, and I. Longbottom, Keighley, "Spool motion for a worsted spinning frame."
„ 14, 3123, J. Emery, Preston, "Wicker-work skip with wooden bottom."
„ 14, 3124, W. Magcough, Grenville Priest-house, Dublin, "Apparatus to ascertain the vertical height of clouds."
„ 16, 3125, Lambert and Co., Portman-street, "Vertical pianoforte brace."
„ 16, 3126, Dunn, Hattersley and Co., Manchester, "Railway turn-table and break applied thereto."
„ 18, 3127, W. Muir and H. Goss, Salford, "Theodolite."
„ 18, 3128, W. Gaves, and J. Hopkinson, New Wharf-road, "Smoking-tube."

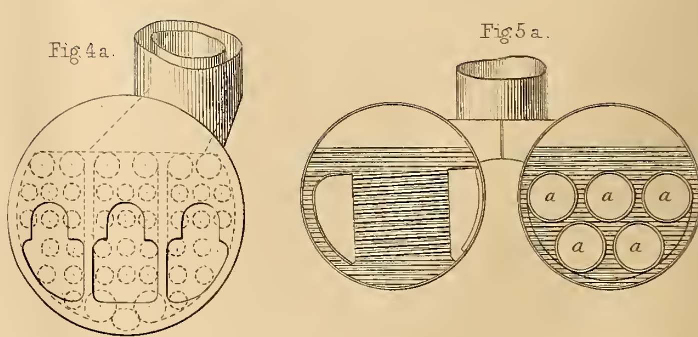


REVOLVING GRATE, BY M. MOULFARINE.



SAND PAPER MAKING MACHINE.





ENGLISH & AMERICAN TUBULAR BOILERS.

W. K. Whytehead, C.E. direx

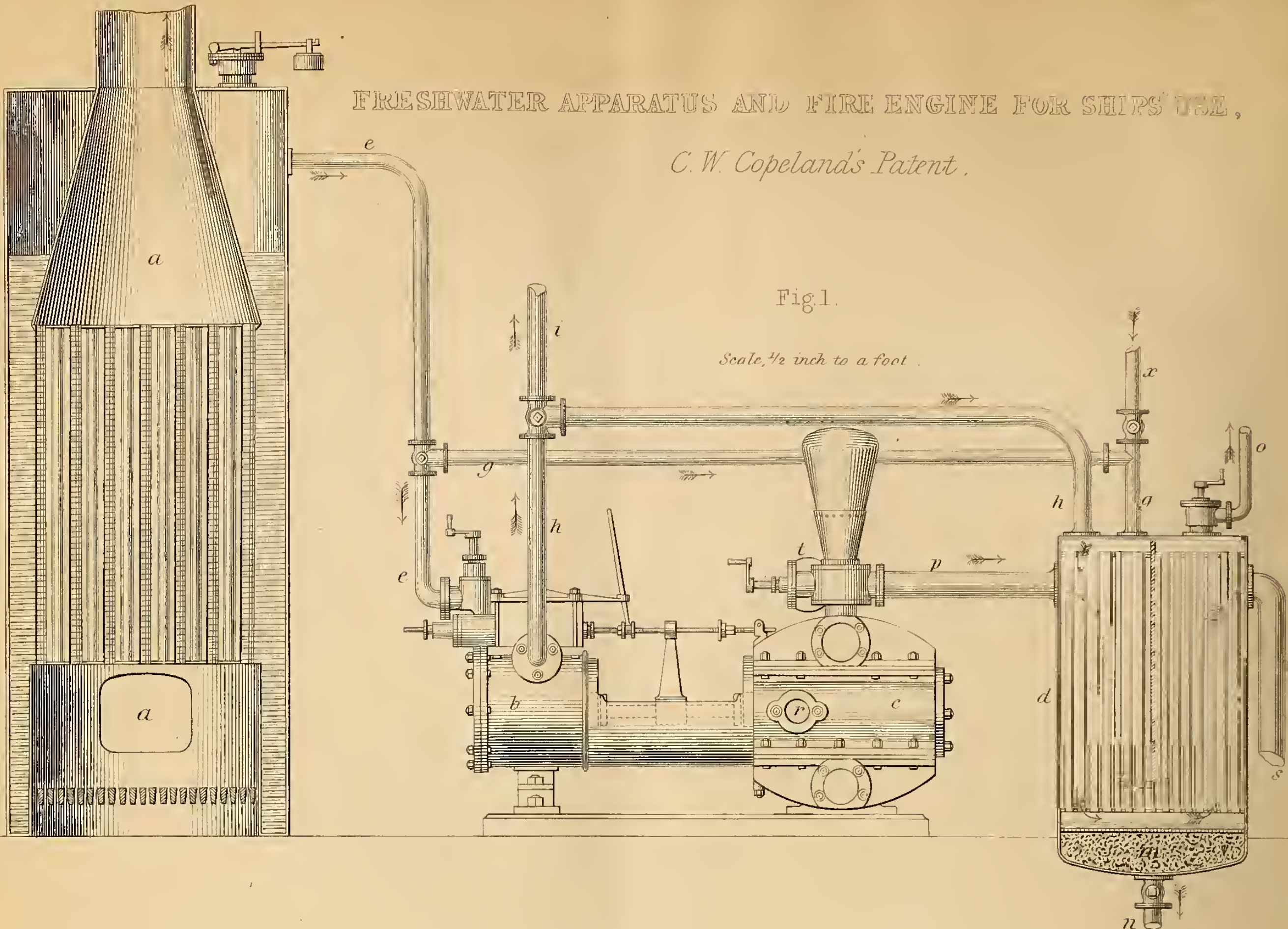
H. Adlard sc

FRESHWATER APPARATUS AND FIRE ENGINE FOR SHIPS' USE,

C. W. Copeland's Patent.

Fig. 1.

Scale, ½ inch to a foot.



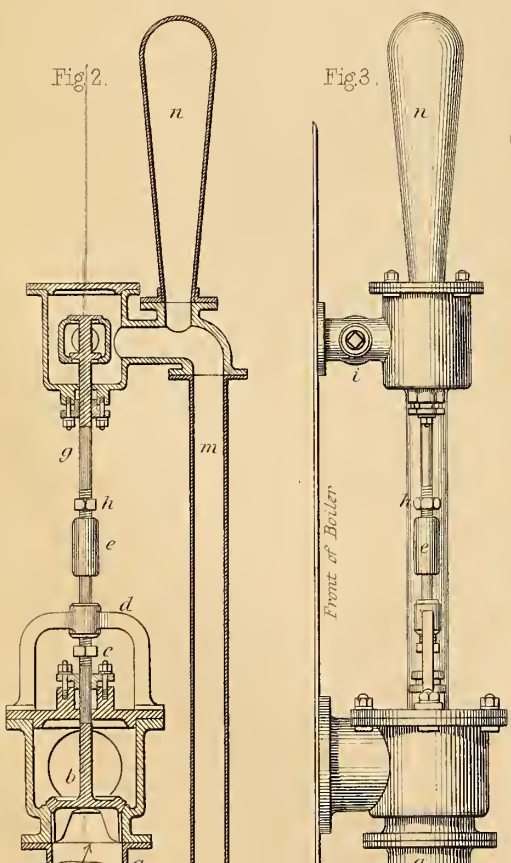
CONTINUOUS BLOWOFF VALVE FOR MARINE BOILERS

AND

METALLIC PACKING,

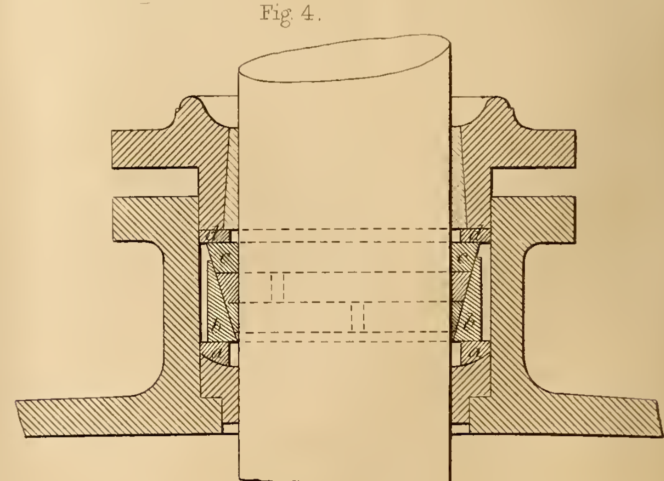
C. W. Copeland's Patent.

Fig. 2. Fig. 3.



Scale, 1 inch to a foot.

Fig. 4.



Scale 2 inches to a foot.

W. K. Whytehead, C.E. direx. H. Adlard sc.

// THE ARTIZAN.

No. IV.—Vol. X.—APRIL 1st, 1852.

ENGLISH AND AMERICAN TUBULAR BOILERS.

Illustrated by Plate 5.

We promised, when noticing Mr. Bartol's work on American marine boilers (*ante* p. 64), to return to this important subject. The chief characteristics of the American boilers are, an immense width of furnace, from 4 feet 9 inches downwards, and the use of large tubes, or, to speak more correctly, of circular flues, in two or three tiers. The diameter of those running into the fire-box appears to vary from 15 to 18 inches, and that of the lower tiers from 7 to 9 inches. They can hardly therefore be called "tubular boilers," in our sense of the word. A few are made with circular flues behind the furnaces, and then a mass of small tubes over, returning the draft to the front of the boiler. This makes the small tubes a great length. In the *Baltimore* they are $3\frac{1}{2}$ inches inside diameter and 16 feet 6 inches long, and, as wood is used, do not, we presume, choke up.

They may be divided into two distinct classes: those in which the return flues are over the furnaces, and those in which they are below them. The latter are called "drop-flue" boilers, and we have engraved one of the *Franklin's* boilers as a specimen. The following particulars of her will be found useful:—

The *Franklin* merchant steamer, running between New York and Havre, engines and boilers designed and constructed by Stillman, Allen, and Co., New York.

	Ft.	In.
Length on deck	263	0
Breadth of beam	41	10
Depth of hold	26	0
Tonnage .. .. .. 2,410 tons		
Average draft of water	18	0
Two side lever engines		
Diameter of cylinders	7	9
Length of stroke	8	0
Diameter of paddle-wheels	32	2
Length of paddles	11	8
Depth of do.	2	0
Number of paddles in each wheel .. 28		
Average dip of wheel	6	9
Average number of revolutions .. 13		
Average pressure of steam .. .. 15 lbs.		
Cutting off at	3	0
Four iron boilers (back to back)		
Whole amount of fire surface .. .. .. 8,528 sq. ft.		
„ „ grate .. .. .. 300 „		
Ratio of fire surface to cubic foot of cylinder, $11\frac{3}{10}$ to 1		
„ grate surface .. .. $28\frac{4}{10}$ to 1		
Area of 1st flues .. .. 57 sq. ft.		
„ 2nd „ .. .. 46 „		
Area of 3rd flues .. .. $43\frac{1}{2}$ sq. ft.		
„ chimney .. .. 50 „		
Height of do. above grate .. .. .. 63 ft.		
Consumption of bituminous coal per hour .. 6,160 lbs.		
Water evaporated by 1 lb. of coal .. .. 5 „		
Coal per hour to square foot of grate .. .. $20\frac{1}{2}$ „		

Fig. 4 is longitudinal section, and fig. 4 *a* a transverse section of one of the boilers. As an apparatus for utilizing a given quantity of heat, we have no hesitation in saying that this arrangement of flues is superior to our ordinary tubular boilers, where the greatest heat is applied at the bottom, and the tubes are surrounded with a mixture of water and steam generated by the furnaces. In these boilers, the furnaces are unusually capacious (as if intended for burning wood), and the heat is applied near the water-level, so that the steam has but a short distance to rise before it escapes from the water, and the water-level has an extended area. The draft descends as the air becomes cooler, so that the caloric is effectually abstracted by the colder water at the bottom of the boiler. This advantage, however, is not obtained without a drawback. How a fresh tube is to be got in without cutting the boiler to pieces, Mr. Bartol does not inform us. Access is obtained to the smoke boxes by making the top and bottom rows of tubes of such a diameter that a man can pass through them; but the space is too confined to admit of doing much in them. As regards strength, this boiler is dependent upon stays for the sides and tops of the furnaces; but there is no difficulty in applying them. Owing to the great height of the furnaces, the water-level is necessarily high, and very little room is left for steam, the steam-chest, although high, having very little capacity. The cylindrical form of the shell renders it independent of stays, except for the ends. This form, however, does not appear to be generally adopted, the furnace end being commonly made with flat sides and bottom, to give more room in the furnaces. It will be remarked, that the evaporation appears very small, but it must be remembered that this is very doubtful, as there is no knowing whether the point of cut-off is adhered to; nor is there any allowance made for blowing off.

With this boiler we may contrast one also constructed with a cylindrical shell, by Messrs. Penn and Son, for H.M.S. *Hydra*.

This vessel is 818 tons, and has a pair of side lever engines by Messrs. Boulton and Watt, of 220 horse nominal power. Cylinders about 56 inches diameter × 5 feet stroke, and make $16\frac{1}{2}$ revolutions. From the new Edition of *Tredgold on the Steam Engine*, we learn that the shells are 9 feet 10 inches diameter × 16 ft. 8 in. long. Each contains 398 tubes, $2\frac{3}{8}$ inches diameter, and 5 ft. 3 in. long. Furnaces 2 ft. 8 in. diameter.

Heating surface in tubes ..	.. 2619.825	
Do in furnaces	.. 429.686	
Total heating surface ..	.. 3049.511=13.861	per horse power
Grate bar surface	.. 117.730=5.35	do.

Water surface 262.208 square ft.=2.227 per sq. ft. of grate bar surface.
Steam room 471.796 =4.007 do. do.
Weight of water 992.376 cubic feet=27.72 tons.
Contents of boilers, 2530.32=11.04 cubic feet per horse power.

Fig. 5 is a side elevation, and fig. 5 *a* a transverse section at the furnaces and tubes, at a scale of $\frac{1}{10}$ inch to a foot. This boiler requires fewer stays than any other tubular marine boiler we have yet seen. The furnaces, *a a*, as well as the shell, are cylindrical, and the small diameter of the former would enable them to resist a high pressure. The arrangement of the furnaces in two tiers allows of a large area of fire-grate being obtained in a narrow width of shell. The position of the tubes *across* the boiler, makes them as accessible as in an ordinary boiler, and they can be renewed with equal facility.

Leaving other points out of consideration, Mr. Penn's boiler is evidently stronger than the American form; and a good high pressure marine boiler is the great desideratum.

Whilst on this subject we may remark on an extraordinary instance of the way in which our American friends tempt Providence, as reported in a late number of the *Franklin Journal.* A boiler of 5 feet diameter was constructed at the factory of Messrs. J. P. Morris and Co. for a steam-boat, and designed to work at 100 lbs. on the square inch.

The shell was .3 of an inch, or bare $\frac{5}{16}$ thick, but that is a trifle compared with what follows. A steam chest 4 feet diameter was put on, and a hole 4 feet diameter cut out of the shell, almost cutting it in halves. It was being proved in the shop to 150 lbs. by getting up steam, and just after that pressure had been attained, it exploded and killed two people. The hole in the shell might have been 18 inches in diameter, and would then have been ample as far as regards the passage of the steam, unless, as is most probable, there was little steam room in the shell, and then, carrying the steam through such a limited area, might have induced priming. In this case an additional pipe might have been taken from over the furnaces, where the production of steam was most vigorous to the top of the steam-chest, or a perforated pipe on Hawthorn's plan might have been used—anything, in short, rather than commit such a monstrous error as cutting a 4 foot hole in a 5 foot boiler. A still better plan, which we adopt with land boilers, if of extra length, is to put two steam-chests of moderate diameter, so as to take the steam off quietly from each end of the boiler.

THE SMOKE QUESTION.

(Continued from page 60.)

THE SELF-FEEDING FURNACES OF MONS. MOULFARINE.

Illustrated by Plate 5.

We have already alluded to several self-feeding furnaces, which accomplish both a saving of fuel and a prevention of smoke, but which have the defects of complexity and great expense. The one least liable to these objections is Brunton's revolving grate, an improved form of which was constructed for the Bank of England by Messrs. Boulton and Watt, which has worked there since 1843 with great advantage. The objection peculiar to this plan is, that it requires a fire-box, which there is no difficulty in applying to a low pressure boiler, but which becomes expensive and hazardous when constructed so as to resist high pressures. Boilers with internal furnaces now have the general preference in this country, and we are not aware of any variety except the locomotive boiler, which combines adequate strength with facility for the adoption of the revolving furnace. A boiler, combining these requisites, is a desideratum which it is left to some future inventor to supply. In the mean time we take this opportunity of introducing to our readers a modification of Brunton's grate, which has been devised and constructed in a very complete manner by Mons. Moulfarine, engineer, of Paris. For the drawing and description we are indebted to Mons. Armengaud, C.E.

In the instance before us, the revolving grate is applied to a boiler, having two generators below the shell, which is commonly used on the continent, and is well calculated for high pressures. (See p. 260, vol. 1851.) Fig. 1 is a front elevation; fig. 2 a longitudinal section; and fig. 3 a transverse section. The fire bars, *a*, form a circular grate, and their ends rest on a cast iron ring attached to a wrought iron funnel, *b*. The weight of the grate is sustained by arms within the ring, having a centre boss, *c*, which carries a brass bush, and revolves upon the fixed spindle, *d*. This spindle is hollow for its entire length, and a small jet of steam is admitted through it by means of a pipe *e*, communicating with the boiler. This jet of steam, which, if the bearing be properly fitted, will be but small in amount, serves to lubricate the bearing and keep it clear of dust. The bottom of the funnel has a cylindrical form, and is kept in position by cast iron arms and a boss, moving on the upright spindle *d*. The bottom of the spindle is carried by a frame *g*, all of these parts being so arranged as to offer as little obstruction as possible to the passage of the air through the funnel to the bars. In order to prevent the leakage of air round the funnel, a ring is attached to it, which revolves in a channel filled with sand, as at *h;* motion is given to the grate by means of a pair of bevil wheels, as at *i*, connected by a strap and fast and loose pulleys to any convenient prime mover.

To facilitate the removal and renewal of any of the parts, a cast iron plate *k k* is bolted on the front of the brick-work. The front of the furnace is bolted to this, so that by loosing a few bolts, it can be removed and access obtained to the interior. Ordinary fire-doors, as *m m* serve to fire by, before steam is got up and the engine is started; when that is effected, the feeding apparatus is thrown in gear.

The feeding apparatus consists of a conical grooved roller, *o*, revolving in a coal hopper, *p*, and driven by the bevil wheels and gearing, *r*. The supply of coal is adjusted by means of the slider *s*, moved by a screw to give the due amount of opening. The connection between the hopper and the fire may be entirely shut off, by means of the damper, *t*. The roller, by its revolution, breaks the coal to an uniform size, if it be too large, and its conical form distributes it equally over the surface of the grate, the greater diameter of the cone feeding the coal faster on that part of the grate which, being nearer the circumference, revolves at the greatest velocity.

M. Armengaud states that the form of the funnel below the fire-bars is found to distribute the air advantageously over the fire, whilst the perfection of the combustion is such that a considerable saving over hand-firing is obtained, there being only a few ashes in the ash-pit. The objection may be raised against this system, that it consists of too many parts. It will, however, be observed that they are chiefly of cast iron, and not liable to be burnt out. At any rate, it is more simple than Juckes', and we are confident may be made as efficient and much more durable.

FRÉMY'S PATENT GLASS PAPER MAKING MACHINE.

The rapid spread of machinery has created a vast demand for the apparently insignificant articles of glass and emery paper and cloth, and we believe we are correct in saying that a large fortune has been made by one firm to whom the credit of introducing the emery cloth is due. The machine we are about to describe appears adapted for the manufacture of emery paper rather than of cloth, and will be found interesting to our readers, many of whom, probably, like ourselves, have used that article, so useful in the workshop, by the quire, without ever thinking how it was made. The machine we are about to describe is that constructed by M. Frémy, of Paris.

Machine-made paper, as some of our readers may *not* know, is produced in a continuous web, which, for ordinary purposes, is cut up into the desired size by a cutting-machine. In the case before us it is kept in its continuous form, but cut to a suitable width for the "emerising" machine. (N.B. This word has been unaccountably left out of all the editions of Dr. Johnson's Dictionary that we have been able to find.) In this machine it has to undergo the following processes:—First, it is smeared with size; secondly, the superfluous size is wiped off; thirdly, the emery, or glass, is distributed over the sized surface; fourthly, the superfluous emery is shaken off; fifthly, the web of paper is cut into sheets, and, sixthly, these sheets are deposited in a receptacle provided for that purpose. A glance at the drawing will show how these operations are performed.

Figure 6 is an elevation of the machine, in section; *a* is the web of paper mounted on a roller, from whence it travels in the direction indicated by the arrows over the rollers *c c*, with which it is kept in contact by a third roller over and between them.

These two rollers are covered with felt and dip into a vessel containing the size. This vessel has a double bottom, the lower part communicating by two pipes, *e e*, with a hot water-bath, *i*, which is heated by a lamp, and serves to keep the size hot in the vessel beforementioned, and also in the reservoir of size, *d*. The paper thus smeared with size passes between a roller and the rubber, *g*, which removes the superfluous size which drops into the vessel beneath. The rubber is made of an elastic material, and is covered with felt. The paper then passes in the line, *h h*, over a table, where the sand or emery is distributed over it from the hopper, *m*, which is provided with an adjusting plate at the lower extremity to enable the supply to be regulated. A wire screen, *x*, prevents any coarse particles from passing.

The paper is then subjected to the action of the revolving brush, *n*, which shakes off the superfluous material, which falls into the receiver, *p*. The rollers, *o* o, perform the measuring and cutting operations, one of them being furnished with the cutters, *s s*, and the other with corresponding grooves. As the paper passes between the rollers, it is divided transversely by the cutters, each sheet being of course equal in length to half the circumference of the cutting roller, and the sheets thus formed fall into the receiver, *r*. This has two compartments, and can be moved on its lower corner so as to bring either of them into the requisite position to suit the delivery of the sheets. A self-acting motion is given by means of a balance weight, which is lifted by the weight of the sheets in one compartment, and releases a detent which allows the receiver to fall over, and the sheets to be removed, whilst the other compartment is filling. As the paper is damp when it reaches the cutters, and would not readily keep in shape, two fingers are provided, one at each end of the grooved cylinder, o, which take into the grooves, and, in the revolution of the cylinder, press the paper firmly against it. They are acted upon by a weight, which is released just at the moment when it is required to permit the paper to fall on the inclined plane of the receiver.

The material which accumulates in the receiver, *p*, is in some of the machines removed by an Archimedean screw, and so raised into the hopper, to be used over again.

All the rollers are of course connected together by wheelwork, to give them the requisite velocity and direction. It is obvious that, in setting the machine to work, a length of paper equal to the distance between the first and last rollers, must be passed through the machine before it can be started. In order, therefore, to save this piece of paper from being wasted, the cutting roller is thrown out of gear, and the sand shut off, so that it passes through without being cut or sanded, and being of a stronger kind, it can be used over and over again, by being glued on the beginning of the fresh web of paper. Instead of using a roll of paper as *a*, it may be fed in, so that before the end of the web has passed into the machine, a fresh web can be glued on, so as not to stop the machine, except in the case of an accidental breakage of the paper.

LACON'S PATENT IMPROVEMENTS IN LOWERING SHIPS' BOATS.

We have often had occasion to remark on the difficulty with which mechanical improvements are introduced into either the Royal or Mercantile Navy. Even on board steamers, where engineers might be supposed to reign supreme, their attempt to ameliorate any of the contrivances beyond the engine-room, is usually looked upon as a most "unwarrantable intrusion," as the play bills have it. No matter how well anything succeeds on shore, it is of no use establishing the fact in arguing with the nautical man. "It will never do at sea, Sir," with a wise shake of the head, extinguishes all argument. Take the case in point, the lowering of ships' boats. Any man of ordinary mechanical skill could strike out half-a-dozen ways of doing it efficiently, so as to fulfil all the desired conditions, that it should be lowered on an even keel, be perfectly under command, and be released, if required, at the moment of touching the water. In fact, we will make bold to say, that it *has* been done, and we have not the slightest doubt that when Mr. Lacon's plan is fairly before the public, more than one claimant will start up and assert his right to be considered the original inventor. It is only when some terrible accident like the loss of the *Amazon* arouses public indignation that any attention is ever paid to such things, and then it proves, only too often, but a temporary fuss, which soon dies away and the popular fancy meets with some fresh attraction. Such a body as the Board of Trade ought not to allow this question to remain unsettled. If they have power, they ought to use it; if they have not, it ought to be given them. Mr. Lacon, in an able pamphlet,* has analyzed the evidence on the loss of the *Orion* and the *Amazon*, and described the plans which he has recently patented for lowering ships' boats with safety.

The following extract from the *Times* will show the manner in which an entirely new steamer, "constructed with all the most recent improvements," as the newspapers tell us, is fitted as regards the lowering of the boats:—

"*January* 8.—The mail-boat, when lowered, was immediately swamped, with about twenty-five people in her, all of whom were lost. The pinnace, when lowered, sheered across the sea before the people in her could unhook the fore-tackle. They were thereby washed out, and the boat remained hanging by the bow. While clearing away the second cutter, a sea struck her and raised her off the cranes and unhooked the bow-tackle. The fore-end immediately fell down, and the people in her, with the exception of two, who hung doubled over the thwarts, were precipitated into the sea and drowned.

"The boats of the Amazon were fitted with iron cranes or crutches on which their keels rested; these fittings obstructed their clearance from the ship, and but for this fatal arrangement the serious loss of life would have been lessened.

"The two best boats were stowed on the top of the sponsons, where the flames prevented approach. After the Amazon was put about she went at the rate of twelve or thirteen knots, dead before the wind. One boat on the starboard-side, the second cutter, was full of people when the wash of the sea unhooked the foremost tackle; she held on by the stern tackle, and her stem falling into the sea, all except two were drowned in consequence of the ship's speed. The pinnace was observed on the port side, towing by the fore-tackle, behind the burning ship, and as no one cut the tow-rope the miserable passengers, who were all huddled together, were, one after the other, washed into the sea. The mail-boat, which was also full of people, having shipped a quantity of water, went down alongside.

* On the Management of Ships' Boats, by W. S. Lacon, H. C. S. London: Parker, Furnivall and Parker.

"Some of those who escaped first attempted to get possession of the best life-boat, placed nearer amidships, but lost so much time in their vain efforts to remove her from the cranes or crutches that the approaching flames drove them off, and they then took to the after life-boat, in which they left the ship."

The case of the *Amazon* was, no doubt, an extreme one, but it is just such a case as might occur again any day, and we therefore, ought not to rest satisfied with anything less than perfect efficiency under even the most unfavourable circumstances. The Report of the Naval Members of the Board of Trade on the loss of the *Amazon*, just published, contains the following recommendation :—

"The fatal consequences of this obstruction (the cranes), have been shown in the evidence, and we should hope the use of these cranes, or of any contrivance which obstructs the ready lowering of boats, may be forthwith discontinued. While upon the subject of the boats, we may advert to the lamentable loss of life, which was occasioned by some of the boats being improperly lowered, and by the tackles not being readily unhooked. *The means of lowering boats evenly, and of readily disengaging the tackles, together with plugs* that are self-acting, are desiderata wanting throughout the naval service.*"

After this candid acknowledgment, the Board of Trade will be self-convicted, if they hesitate any longer to insist on a remedy being applied.

The following engravings will explain Mr. Lacon's arrangement. Fig. 1 is a side elevation of the bulwark and lowering machinery, looking from inside the ship. Fig. 2, a transverse section of the boat, davits, and gear. Fig. 3 is an enlarged view of the friction brake and pall-barrel.

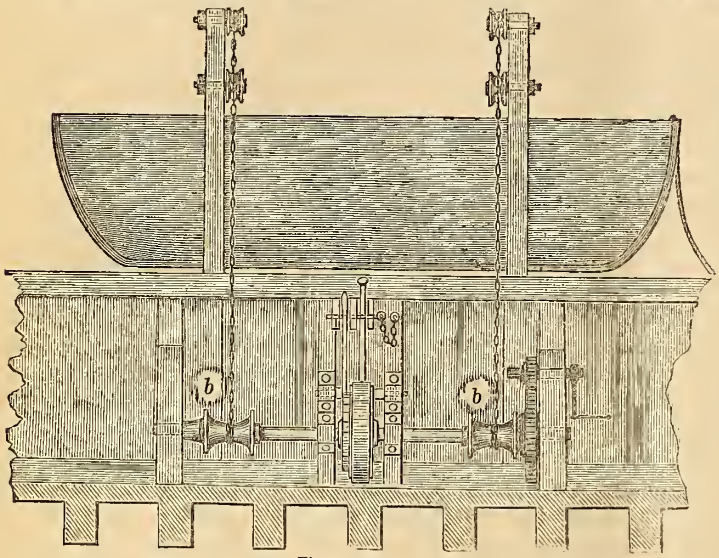


Fig. 1.

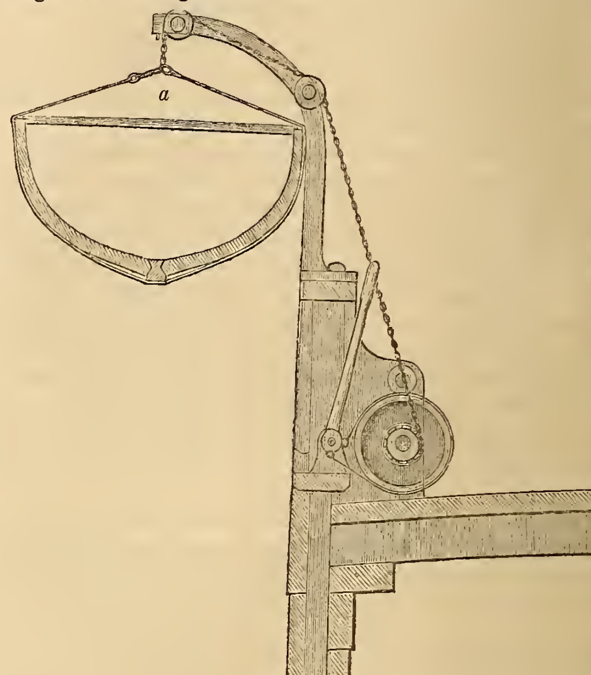


Fig. 2.

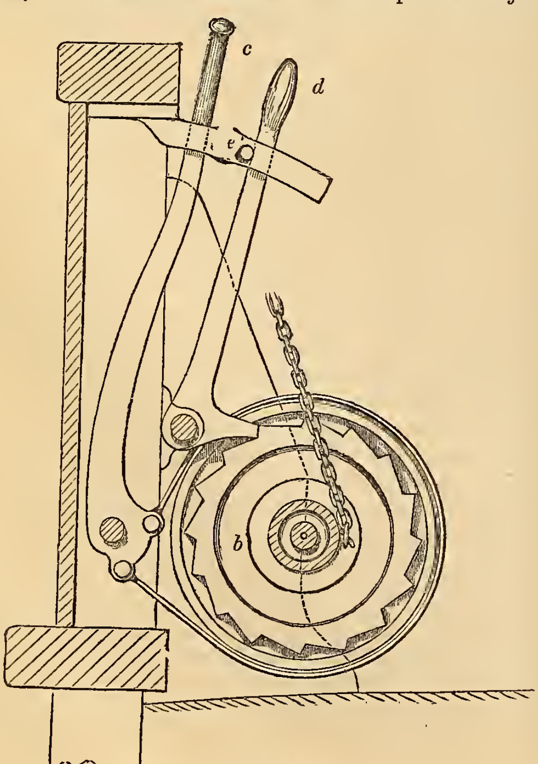


Fig. 3.

The hoisting and lowering gear consists of a single-purchase crab, on the main spindle of which are two chain barrels, a friction brake, and a pall barrel.

The boat may be hoisted up as usual, with tackles; while suspended, two broad slings, having a ring at each end, are to be passed round and underneath the bow and quarter of the boat; one end of each sling is made fast to a suspending chain or rope, whilst the other end is also secured to the suspending chain by a lashing, as shown at *a*, fig. 2. These suspending chains are carried over sheaves in the davits, to the concave barrels, *b b*, in each of which there is a pin over which the last link of the chain is placed. These barrels are fixed on the main spindle of the crab, which works in standards fixed to the deck and bulwarks. In the centre of the spindle is the brake and pall-wheel, having a brake handle, *c*, and a pall-handle, *d*, which are secured by a pin, *e*, which can only be removed by a key as will be presently noticed.

The chains having been hove taut by means of the crab-handle and the pall thrown in gear, the tackles may be removed and the boat left hanging by the chains. It is proposed that a painter shall be attached, at all times, by one end to the bow of the boat by two half-hitches, and by the other end by two half-hitches to the ship, and that the lashings by which the boat is secured to the ships' side when at sea, shall be passed round small timber heads on the bulwarks, instead

* Lieutenant Stevens' very simple and effectual contrivance for this purpose will be found illustrated at p. 259, vol. 1850.

of as now, lashing them to eye-bolts in the ship; they may thus be easily thrown off, cut, or let go. The following we quote from Mr. Lacon :—

" *Whenever the order may be given to lower a boat*, two men, having thrown off the ' nose-lashing' and the lashing of the ' gripes,' will get into the boat, and having cast off some of the turns of the lashing of the slings, will hold the ends in their hands in readiness, while a third man will take his station at the lever of the friction strap or gripe.

" *When the men in the boat are ready*, the man inboard, withdrawing the bolt, pressing forwards the lever of the friction strap or gripe, and lifting the pall from the ratchet-wheel by throwing back its handle or lever into a self-acting catch, may, by regulating the action of the friction strap, lower the boat slowly or quickly, irrespective of any weight that may be in her; and when the boat reaches the water, if the men in the boat let slip the lashing of the slings, the boat will be clear, and the slings and chains may be hove back into the ship by means of the winch.

" But in cases of emergency, when, either from the rapidity with which the ship may be going through the water, from a heavy sea, through want of time, or from people rushing into the boats, *it may be dangerous to cast off the lashing of the slings*, or if in attempting to let go the lashings of the slings, either of them should foul, then, if the friction strap be slackened when the boat reaches the water, the weight of the chains and the resistance of the boat will pull round the barrels, and the ends of the chains not being fast, will slip from off the projecting pins of their respective barrels, and will be lowered into the water, being prevented from going down by the run by means of two small lines, the loop or eye at the end of each slipping from off the pin, when the turns of the lines have run off the barrels, and the boat, as before, will be free of its connection with the ship.

" The boat will now ride alongside in safety, by means of the painter, and the slings and chains may be hauled into the boat; or, if the lashings of the slings be cut or let go, the slings and chains will sink into the water, clear of the boat.

" By suspending the boat, in the manner thus described, with two stretchers to prevent the slings pressing in the gunwales, the straining of the boat at the tackles, a matter so much dreaded by the shipowner, is guarded against, the use of ' chocks,' ' keel-cranes,' and ' crutches' is dispensed with, and the boat cannot, as is the case in lowering with the tackles, cant to one side or the other, but must go down into the water upon an even floor. By having the after-chain a few inches longer than the other, the boat would drop sufficiently by the stern (while hanging at the davits) to ensure any water running out at the plug-hole, and moreover in lowering, it would cause her stern to strike the water first.

" In going into harbour or into dock, or in the event of ships coming in contact with ice, when it is necessary that the boats should be swung inboard, if slings have been passed from forward, aft, and *vice versâ*, crossing under the bottom of the boat, the inner end of each sling being attached to the suspending chain, and the outer or unattached ends being secured to the suspending chains by a lashing, the boat may be swung inboard by the suspending chains.

" As regards the boats' covers, which you are aware are only necessary in hot climates, but which, in the navy, are removed every night, and which, by the present system—*being frequently lashed to the boat underneath!*—must necessarily be an obstacle to the speedy ' clearing-away of the boats,'—I propose that they shall be laced *above*, from the stem to the stern, the gripes being passed over all.

" In cases of emergency, the cover thus secured, might be lowered with the boat, and if the lacing be cut, even when the boat is in the water, the weight of the wet cover, being over and outside the slings, would cause it to sink clear of her."

All these mechanical improvements will, however, be of little avail unless a proper routine of duty is maintained. Mr. Lacon proposes that the officers only should be entrusted with the keys for throwing the palls out of gear, to prevent panic-struck passengers from seizing them by main force.

He also suggests " that it be made law, that after the ship has put to sea, the mate, every night before dark, shall report to the captain (and that the same shall be entered in the log), that nothing is in the boats except what belongs to the boats, that the painters are rove, the oars in the boats and lashed, and that the plugs are in their places—that the boats are in an efficient state, and that everything appertaining to them is ready for the most critical emergency."

We trust to see this plan, thus mechanically worked out, have a speedy and satisfactory trial, that public feeling may not again be outraged by such a wholesale sacrifice of human life as we have so recently experienced.

FRESH WATER APPARATUS, AND FIRE-ENGINE FOR SHIPS' USE.

C. W. Copeland's Patent.

Illustrated by Plate 6.

This invention is of a character which will prove of considerable importance to our mercantile navy. It embraces two distinct objects,—one, the supply of fresh water by distillation,—the other, the extinction of fire, or similar purposes. The first of these objects has been already attained in our own and the French navy, but not in combination with the second, which may be considered the peculiar feature of Mr. Copeland's arrangement. The economy of the distillation of fresh from salt water on the voyage, depends simply upon whether it is cheaper to purchase and carry 1lb. of coal or 7 of water. In reducing this to figures, it must not be forgotten that fresh water is not always readily obtainable in port, and has to be paid for at any rate. However this may be, there can be no question about the importance of being rendered independent of accident, by having on board ship the means of supplying any deficiency of a prime necessary of life. The second of these objects, the extinction of fire, has been recently illustrated in so fearful a manner by the loss of the *Amazon*, that no statement of ours is needed to strengthen the effect. We need only add that the Report of the Board of Trade especially points out the importance of the right application of an auxiliary engine to this purpose. Having premised thus much, we will describe the arrangement which Mr. Copeland has adopted in the vessels of the United States navy, and the operation of which we have had an opportunity of inspecting.

Fig. 1, plate 6, represents an elevation, partly in section, of a boiler, steam-engine, pump, and condenser, which occupy but a very small space, and may be placed on mid-deck.

The boiler, *a a*, is of the ordinary vertical construction. The only noticeable peculiarity in it is, that no part of the tubes is left uncovered by the water, and that the smoke-box, or take-up into the chimney, is constructed of such a shape as to give a better amount of steam space than usual.

b is the cylinder of the auxiliary engine, and *c* a double-acting pump; *d* is the condenser.

The steam-pipe, *e*, conveys steam from the boiler to the engine, or when the power of the engine is not required, it may be led by means of the branch pipe, *g g*, directly from the boiler into the condenser.

The exhaust steam from the engine is conveyed by the pipe, *h h*, to the condenser, *d;* or when the distilling apparatus is not required, it may be blown into the chimney by means of the pipe, *i*.

The condenser, *d*, is cylindrical, and is divided for a portion of its depth by a vertical partition. The steam to be condensed passes through the tubes, and the fresh distilled water produced passes

through the filter, *m*, by the pipe, *n*, to a tank placed in any suitable part of the ship. Any steam which may avoid condensation escapes through the pipe, *o*.

The pump, *c*, draws water by the pipe, *r*, from the sea, and delivers it through the pipe, *p*, into the condenser, where it passes outside the tubes (condensing the steam in them by its refrigerating powers), and through a space left at the bottom of the partition, by the course shown by the *dotted* arrows, and finally escapes overboard by the pipe, *s*.

When the pump is used as a fire-engine, the water is shut off from the condenser, and pumped through one or two hoses attached to the flange, *t*.

One only other pipe remains to be noticed. We have hitherto spoken of the apparatus as applied to a sailing vessel; but as it may be applied with equal advantage to steamers, a pipe, *x*, is then provided, by means of which steam from the large boilers may be conducted to the condenser, and the distilling go on, without getting up steam in the auxiliary boiler.

A great advantage in having an auxiliary boiler is, that when in port, or if from other circumstances the large engines are not employed, steam may be got up in a very short time, and *with very little trouble and expense*, and the engine set to work to pump out bilge water, to fill the large boilers, or to act as a fire-engine.

There are some points about the details of the engine and pump which we must remark on in our next number. One of the engines has been imported by Mr. A. P. How, Mr. Copeland's representative in this country, which we have seen at work. The volume of water thrown by it is immense, and both engine and pump work perfectly noiselessly—a fact which we were not prepared for, from the usual performance of this arrangement of engine.

This engine is now at work at the Great Northern Railway station, King's Cross, and in our next we will give some account of its duty.

COPELAND'S PATENT SELF-REGULATING BLOW-OFF FOR MARINE BOILERS.

Illustrated by Plate 6.

Mr. C. W. Copeland, Chief Engineer, United States' Navy, has recently patented in this country a simple and efficient blow-off apparatus, with a description of which he has favoured us. It proceeds on the principle of making the supply of feed-water regulate the amount of blow-off. In plate 6 it is represented as applied to the boilers of the *Mississippi;* fig. 2 being a front elevation, and fig. 3 a side elevation in section. The following description is given by the author:—

The water delivered by the feed-pump enters through the pipe, *a*, and lifts the check-valve, *b*, some certain height, depending upon the quantity of water entering the boiler. This may be regulated by the nut, *c*, on the stem of the valve, which is prevented rising beyond a certain height by the guard, *d*. On the stem is a socket, *e*, in which the stem of the blow-off valve, *g*, works freely. On this stem is also a regulating nut, *h*, which the socket, *e*, lifts in rising, and the blow-off valve with it. At every stroke of the feed-pump, therefore, *if water be delivered into the boiler*, a certain fixed quantity is allowed to escape by the blow-off valve. The stop-cock, *i*, is attached between the boiler and the blow-off valve, for convenience of shutting off the communication when it is desired to examine the valve, and a pipe is led from this to any part of the boiler from which the blow-off is to be taken. The blow-off pipe, *m*, is connected to the ordinary system of pipes leading to the sea, as is usually practised; the air-vessel, *n*, is attached for the purpose of preventing the shocks to the pipe which the intermittent action of the blow-off is liable to produce. It is obvious that the general arrangement may be varied to suit circumstances.

ADVANTAGES OF THIS SYSTEM.

1st.—It is the only apparatus which has been arranged to operate upon correct principles,* as it is evident that, to maintain a given density of water in the boiler, the quantity blown off must bear some definite fixed relation to the quantity evaporated, which is done in this case, as the very operation of supplying water for evaporation also blows off a certain quantity; the pressure of steam or speed of engine having no effect which does not equally affect the quantity supplied.

2nd.—The valve is directly before the fireman's eye, and, should it cease to operate can be readily detected.

3rd.—It is constantly in operation, instead of being periodical, like blowing off by hand.

4th.—A necessary result of the arrangement is, that if *no* water is supplied to the boiler, none is blown off.

5th.—By its uniformity and regularity of action, it adds much to the economy of fuel.

It may be considered that there are at present three different methods of blowing off the partially-saturated water from marine boilers:—

1st.—"Blowing by hand," in which the fireman or engineer blows off, at certain intervals of time, the amount of water required.

2nd.—"Constant blow-off," in which a small blow-off cock is kept constantly open to the extent necessary.

3rd.—"Brine-pumps," which are constructed of fixed dimensions, and kept constantly in operation by the engineer.

Let us now see what are the objections to these modes of blowing-off, and the reader will be able to judge how far tne objections apply to the "Patent Valve."

1st.—"Blowing by hand;" the water is not kept at a uniform density, and fluctuates between certain extremes, depending upon the intervals of time, and quantity blown; it is liable to accident (as has frequently occurred), from carelessness of men, in neglecting to shut the blow-off cock until the water is blown out, and the boiler burned, and possibly an explosion ensue. It requires the constant attention of the engineers to see that the proper quantity is blown off, whereas with my valve, the regulating screw, once set properly, requires no alteration or attention, so long as the quantity of water evaporated in a given time remains unchanged.

2nd.—"Constant blow" makes no noise in its operations, and there is no mechanical movement united with its operations, so that there is no mode of detecting a stoppage in the pipe, or any other difficulty, except by a critical examination. It does not depend, in every manner, upon the operations of the engines, and therefore may carelessly (as has been the case) be left open after the engine is stopped, and thereby the water may be blown below the flues, or perhaps the whole be blown out.

3rd.—"Brine-pumps" are liable to the same objection, in regard to knowing of their operation, as the "constant blow;" only still worse, as their operation is much more easily deranged than the "constant blow." As the dimensions of these pumps are fixed at the time of construction, they take from the boilers a fixed quantity of water at each revolution of the engine, whether the evaporation be 100 cubic feet per hour, or 1,000 cubic feet; the quantity of water taken off depending only upon the velocity at which the engine is working, and this varies with drafts of water, wind, sea, &c.; consequently, if the dimensions of the pumps are sufficient to take off the requisite quantity of water at the minimum speed of the engine, they must be much more than sufficient at the maximum speed, and a waste of fuel is the necessary consequence.

COPELAND'S PATENT METALLIC PACKING.

Illustrated by Plate 6.

The introduction of metallic packing for the pistons of steam-engines was justly considered an immense improvement, and it appears an extraordinary fact that the same principle has not been brought into use

* It is of course understood that Mr. Copeland is speaking of the United States. A more complicated arrangement, as used on board the West India Mail steamers, has been described in the *Artizan.—Ed.*

for packings generally. The use of a sheet brass lining inside the ordinary hemp-packing was suggested some years back in the *Artizan*; but any plan such as the one before us, which dispenses altogether with the use of hemp, is still better.

Fig. 4, plate 6, represents a section of a piston-rod stuffing-box, fitted with metallic packing, consisting of rings of composition metal, of a conical form on the exterior, and fitted into a matrix of a suitable form, of wrought or cast-iron.

a a is a ring of composition, fitted to the bottom of an ordinary stuffing-box, to obtain a plane surface.

b b is the matrix, and *c c c* the packing rings, cut to allow of their contraction as they wear, and placed so as to break joint.

d d, a ring of composition on which the gland bears to press down the packing rings.

The metal of the rings is composed of 9 parts of tin, and 1 of copper. It will be observed that the matrix and rings are of rather smaller diameter than the inside of the stuffing-box; this is for the purpose of allowing the packing to move to suit any irregularity in the parallel motion or guides of the piston-rod cross-head. This packing, which has been patented in the United States by Messrs. Allen and Noyes, has been applied there to a number of steamers, including those of the Collins line, with great success. It has also been in use for three years on the Albany and Boston Railway, with the same good results, which must be regarded as a severe test of its durability, whilst there can be no doubt of its keeping the rods in superior condition to hemp packing, more particularly with high-pressure steam.

REPORT ON SCREW STEAM BOATS, EMPLOYED ON THE GRAND CANAL.

By Sir John Macneill, C.E., F.R.S., &c. &c.,

To the Directors of the Grand Canal Company.

Gentlemen,—I regret exceedingly that from various causes, over which I have no control, I have been prevented until now from reporting on the two steam boats in use on your canal, although the experiments made with them have been completed some time; but I hope my preliminary examination and report on these two boats, has prevented the inconvenience that would otherwise have arisen from this delay, as it has enabled you to order a boat which, I have no doubt, will be found more suited to the traffic on your canal, than either of those now employed upon it. I do not, however, claim any merit for the plans or arrangement of the machinery intended for this boat, all of which were prepared by your own officers, and whatever merit it may have is entirely due to them; all that I could do was to satisfy myself from the experiments and examination of the two boats, which was the best constructed, and, under similar circumstances, produced the best effects, and to recommend to you that form of construction for the boat you were about to build, which, from these experiments I was enabled to do with perfect confidence; at the same time, I do not by any means pretend to say, that a better form of boat, and more efficient machinery may not be hereafter constructed, when more experience and practical knowledge shall be obtained by the working of these boats; for, when locomotive engines were first introduced upon railways, they were very much inferior to those now used; almost every one that has been since made, up to the present time, has been an improvement on those previously constructed, either in strength, efficiency, or economy of working; and I have no doubt but similar, or at all events, very great and important improvements will be made in steam boats for canal purposes, when they become to be more generally used, and more attention shall be paid to them by practical men.

In order, however, to enable me to report on the queries put to me by your secretary (a copy of which is annexed hereto), I thought it necessary to make a careful examination of the two boats at present at work on your canal, and also to ascertain by experiment the power and capabilities of each of these boats, under different circumstances, as well in reference to the load they could carry, as to the load they could haul with different velocities. In making this examination and experiment, I was assisted by your excellent secretary, and intelligent superintendent of works, Mr. Talbot, who gave me every information, and aided me in every way in their power.

The first of these boats which I examined, called No. 2 boat, was constructed by Messrs. Robinsons and Russell, of London. It is built of iron, without ribs; is 60 feet long, and 12 feet beam, and is propelled by one screw, driven by an engine of the following dimensions:—boiler, 2 feet 6 inches diameter, containing 74 tubes of $1\frac{3}{4}$ inches diameter, each; the length of the tubes is 4 feet 6 inches, with two oscillating cylinders of $5\frac{1}{4}$ inches diameter, and $15\frac{5}{8}$ inches length of stroke. Pressure 50 lbs., and calculated to make 120 strokes per minute; the thickness of boiler $\frac{3}{8}$, with 5 stays of round $\frac{7}{8}$-inch iron to strengthen the steam chambers.

The diameter of the screw is 4 feet, width of blade 1 foot $11\frac{1}{8}$ inches pitch of screw 6 feet, stern post $5\frac{3}{4}$ inches below keel level.

(To be continued.)

ON PROMOTING THE EFFICIENCY OF MECHANICS' INSTITUTES.

That our Mechanics' Institutes have been a failure, is the rule, and it would not be difficult to point out the causes which have produced a result so contrary to the sanguine expectations of their founders. It was proposed some time since, by the editor of this journal, to make the Literary and Mechanics' Institutes throughout the kingdom the channels through which new inventions and manufactures should be introduced to the public. Under the ordinary system, a heavy expense must be incurred in employing travellers, who have to satisfy, not the wants or tastes of the consumers, so much as the caprice of the retail tradesmen, who always prefer and recommend those articles on which they are allowed most profit. These expenses are most felt on articles of *moderate price and class character*, and in many cases the profits on useful inventions, not admitting of a very extended sale, are swallowed up in canvassing and advertizing.

It was proposed that one institute in each county should form the "receiving house," to which contributions from the manufacturers in other counties should be forwarded. A few large cities would form exceptions. Each article to be accompanied by a sufficient number of descriptive circulars.

Meetings to be held at each institute, say every fortnight, at which the merits of the articles exhibited would be discussed.

A report of the opinions expressed on each article, to be forwarded to the contributor for his information.

The articles *then* to be forwarded to the next institution, and so on.

General contracts to be made with railway companies to diminish expenses of carriage.

A scheme of a similar character has been suggested by Mr. Chester, and as we gather from a circular issued by the Society of Arts to the various institutes, is likely to be worked out. No public body has the power of doing it so effectually, and we trust to see some life infused into all our Mechanics' Institutes through their agency. The following letter by Mr. Chester will indicate his plan of operations:—

Highgate, November 28th, 1852.

Sir,—Being desirous that the attention of the Council of the Society of Arts should be drawn to a subject which I am persuaded is of considerable importance, and consistent with the Society's objects, I beg leave to request your perusal of the following exposition of my views, in order that, if you coincide with me in the opinion which I have just expressed, you may take a fitting opportunity of presenting the subject to the Council.

I have to propose that an effort should be made to develope existing, and to create new, institutions of the class commonly called literary and scientific institutions, mechanics' institutes, &c., and to affiliate them on the Society of Arts.

As some excuse for what may be deemed my temerity in making such a proposal, I may mention that I have had considerable experience in reference to national education; and that I was one of the originators, and have been (from the origin of the society) the president, of the Literary and Scientific Institution in this place.

There is now scarcely a town, or considerable village, which has not its institution under some form and name: but, with very rare exceptions, the institutions are generally in a languishing condition, both as to funds and as to usefulness. I do not mean to assert that they are of no use, but merely that they are not half as useful as they might be.

The Exhibition has given us some very significant hints that it is

not only the education of our poor children that needs to be improved; high and low, rich and poor, old and young, have all an education question to be solved; have all a very real and urgent need of knowledge, and of knowledge of that kind which a literary and scientific institution, if fully developed, is well calculated to assist in affording.

I conceive that there are three grand defects which impede the usefulness and the strength of the institutions.

1st. They are not sufficiently practical in their aims.

2ndly. They are isolated and have no means of combining with other institutions for the common good.

And 3rdly. They have no connection with the great central associations which pursue, under national auspices, the objects of literature, science, and art.

1st. That they are not sufficiently practical. I conceive that a literary and scientific institution ought systematically to investigate, and diffuse information respecting objects of practical utility.

The Highgate Institution some years since fully investigated the subject of cottage gardens and allotments, and the result was, the establishment here of a considerable number of allotments upon a plan which has worked with complete success.

We are now making an enquiry into the domiciliary condition of our poor, and collecting information as to the best means of improving it. The Institution itself will not undertake any building or other operations with a view to the improvement; but will ensure a full ventilation of the subject; and the result, in all probability, will be that, (as in the case of the allotments) the business of improvement will be effectually taken up by some of those who will be moved to the work by the information which the Institution will furnish.

I need not point out how rapid a progress will be made, in all parts of the country, in improving the dwellings of the poor, in sanitary measures, and in the use of scientific inventions, if the local institutions throughout the kingdom could be led systematically to aim at these very important objects. Questions also of political economy (not politics) and social law, I conceive, should be treated in the theatres of these institutions. How much the passing of useful laws would be facilitated if this were the case! Not to be tedious, I would instance the laws of partnership, of bankruptcy, of patents, of master and servant, as suitable for discussion by competent persons in such places. And again, how little are the great mass of the middle classes acquainted with the useful inventions which (*e. g.*) receive medals from the society of Arts! Why should not these be systematically introduced to the notice of the institutions?

The Highgate Institution has entered upon this branch of duty, and is preparing to have a descriptive exhibition of the various applications of gas, to lighting, warming, cooking. How very few persons have ever seen a gas cooking apparatus! what ludicrous prejudices are entertained on this subject! I cannot but think then that the strength and usefulness of the institutions would be greatly increased if they could be moved to be more practical in their aims, and to labour (in a due proportion) in the directions to which I have adverted.

2ndly. They are isolated, and have no combination for the common good. The evils of this isolation are too obvious to need any comment: and many attempts have been made to combine the institutions for the purposes of engaging lecturers, obtaining apparatus, and putting into circulation books, works of art, natural objects, &c.

In Yorkshire, a considerable association of institutes exists; and I believe it is productive of good.

What we want, however, is a central office in London, to which we could apply for advice, information, and assistance. Such an office might form an extensive staff of lecturers, men eminent in their special subjects; might collect illustrative specimens and diagrams: and on application supply the local institutions with lecturers and lectures on almost any subject. By judicious *geographical* arrangements the most distant institutions might be supplied at a reasonable rate with lecturers whom they are now entirely unable to remunerate because they cannot ensure to them other engagements in the same neighbourhood.

Whether such an office as I have alluded to should be created for the purpose, or whether any existing body, such as the Society of Arts, could undertake it I am unable to say.

But, 3rdly, the local institutions have no connection with the great central societies.

If the institutions could be connected with the British Museum, the Association for the Advancement of Science, the Geological, Botanical, Zoological, and other Societies, whose objects may fairly be considered to come within the scope of the institutions, I cannot but think that great good would result both to them, and to the Central Societies.

Above all others, the Society of Arts appears to me to be a society with which institutions might unite, by affiliation, with mutual advantage.

I refrain from entering fully, at present, into this subject, because the Council, if they should approve of the idea, would not need my exposition of its merits; and because I am unwilling to add to the length of a letter too long already.

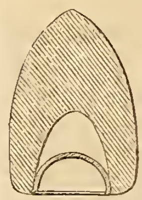
If you should be of opinion that the subject is one which the Council of the Society would be likely to entertain, you will have the goodness to make such use as you may think fit of what I have written in this letter.

I have the honour to be, Sir,
Your obedient servant,
HARRY CHESTER.

George Grove, Esq.,
Secretary,
Society of Arts.

BECKWITH'S IMPROVED BULLET MOULD, FOR THE DELVIGNE OR MINIÉ RIFLE.

"Wars and rumours of wars," are music, we suppose, to the gunmakers, at any rate, matters of business, and they are accordingly bestirring themselves to meet the exigencies of the times. At another page we have given engravings of the Prussian gun, which is highly ingenious, but requires a total change in our fire-arms. The system of Captain Delvigne (miscalled the "Minié rifle," as we are assured from an inspection of Captain Delvigne's French patent, which he has submitted to us), admits of our employing the ordinary rifle, whilst the facility of loading is much increased by the ball being smooth.



The accompanying sketch of the ball, full size, shows its construction. It is made hollow, to throw the centre of gravity forward, and ensure a correct line of flight. A thin wrought iron cup is inserted at the base, which, when the explosion takes place, forces the cup into the ball, and thereby expands it, making it assume the shape of the groove in the barrel. The windage is thus annihilated, and an almost incredible range obtained. The mould adapted for casting this bullet is shown in fig. 1 open, and in fig. 2 shut. The improvement consists in making the core a fixture, whereby greater accuracy is obtained in the casting, and in making the runner at the side of the ball instead of at the point, which tends to make the ball more solid, and easier cleaned from the runner.

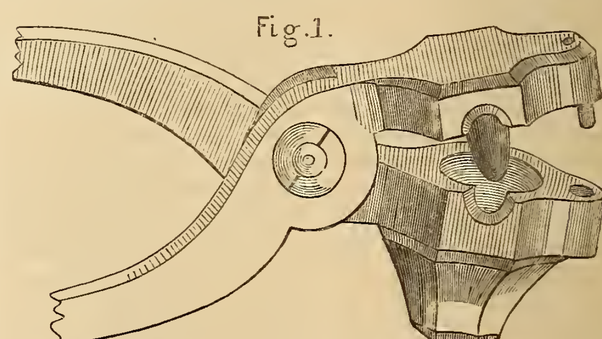


Fig. 1.

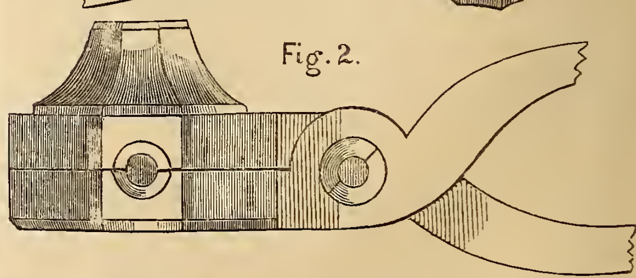


Fig. 2.

THE PRUSSIAN NEEDLE GUN.

(From *Observations on Fire Arms*, by Colonel Chesney.)

The progress of the Zundnadelgewehr, or needle igniting musket, was slow at first; but the fusileers having been so armed, its adoption gradually became general, and it will probably be used ere long throughout the Prussian army. It combines the use of percussion with that of a particular kind of ball, which being conical at the point, cylindrical in the centre, and round at the larger end, is, as in the case of the French projectile, a good deal heavier than a sphere of the same calibre. It becomes rifled as it passes through the barrel, and is propelled with much greater force than the ordinary rifle ball, owing to two causes, viz., a suitable centre of gravity, and the more perfect ignition of the powder, which takes place in front, instead of being as formerly at the other end of the charge. This advantage, one of the greatest belonging to the change, is accomplished by means of a metal needle and a spiral spring. The spring serves the purpose of a lock, and by forcing the needle through the charge, the fulminating powder explodes it in a way which will be better understood from the following details:—

The barrel of the Zundnadelgewehr is 34 inches long, and is rifled with four grooves, taking $1\frac{1}{4}$ turn in the length, and has a high back sight, A, fig. 3; it is screwed into the end of a strong open guider or socket, B; the chamber, properly so called, is bored out in a slight degree conically from behind, C, so that when the cartridge is placed in it, the shoulder of the ball (which is of a particular shape) shall meet and be stopped by the projections of the ribs of the rifling, the body of the ball being of sufficient diameter to fill the full depth of the grooves. Inside the guider slides an iron tube, E, with a strong helve or handle attached, and having a space at the front end next the barrel of about $1\frac{1}{2}$ inches in length, F; in the middle of this space is the needle conductor, G, which is pierced with a small hole in its entire length, through which passes the needle that is to ignite the charge. This needle conductor is screwed from behind into a solid plate of iron left in the tube, H; and this plate it is which (like the breech pin-piece of the ordinary musket) receives the whole reactionary force of the charge. Behind this plate, again, there is a second tube of iron, I, having a spring with double catch attached, and carrying within it an inner small tube, J, which has two projecting rings on one moiety of its length, and a spiral spring in the other, K, and through this tube passes the *needle*, which is a thin steel wire pointed at the end destined to ignite the charge, the other end being screwed into a brass head, which again screws into the interior tube that carries the spiral spring. The trigger, L, is of a peculiar form, with a straight spring, M, having two knuckle movements acting upon a ball; the first movement fires the gun, and the second admits of the whole mechanism being taken out behind, when the parts can be taken to pieces, cleaned, and put together again by a soldier in two minutes, there being no pins whatever, and no screw, except that by which the needle is connected with the inner tube, and this is never disturbed, except when the needle has to be replaced by a new one.

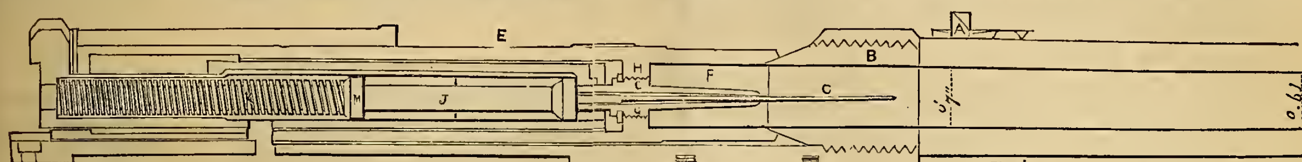


FIG 3

FIG 4

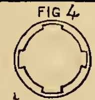
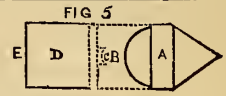


FIG 5



SCALE OF INCHES

FIG 6

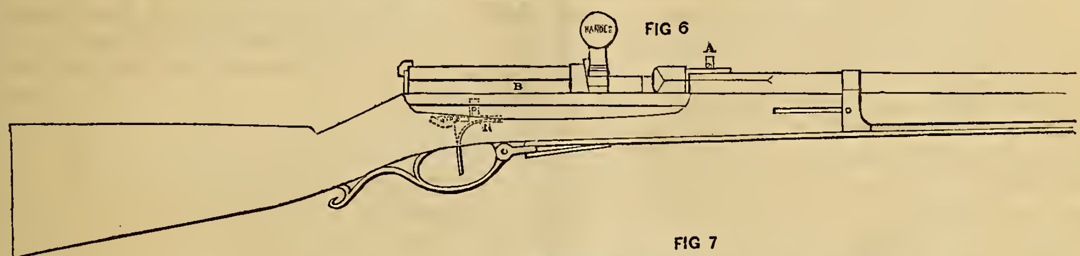
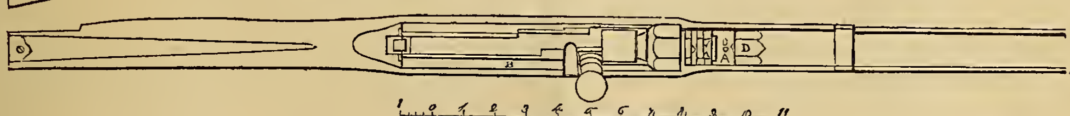


FIG 7



SCALE OF INCHES

The cartridge, fig. 5, is made of one thickness, of thin but strong paper. A is the ball, B the paper bottom, with C, the indentation in its lower end for the priming composition; D is the powder. The end of the cartridge at E is formed also of a single thickness of paper; through this the priming needle is forced by the spiral spring. The needle passes through the whole length of the charge of powder, and penetrates the primer C, which it ignites, and consequently the charge is lighted in front, instead of the other extremity, as usual; and behind the charge there is an empty space in the sliding-tube of $1\frac{1}{2}$ inches long. To these two circumstances the Prussians attribute the additional range and the slightness of the recoil.

Besides celerity in firing, which, without over exertion, extends to about six rounds in a minute, and entire freedom from windage, by which a range of 800, or according to some, even 1,200 yards is obtained, there are several advantages attending the use of this weapon.

As already mentioned, a ball, for the same bore, is much larger than that of an ordinary musket, and being formed by pressure, it is more solid, and has, at the same time, a more correct position of the centre of gravity. Having the advantage of being rifled also, it is truer in its flight than the round bullet, especially as the powder is not crushed, as is frequently the case in ramming down an ordinary musket or rifle. Added to these advantages, it receives a greater impulse, and the pasteboard wadding, which is a part of the cartridge, assists in clearing the barrel from the effects of the previous discharge; and as the soldier can load almost as easily in a recumbent as in an upright position, he

need not, when once behind cover, allow any part of his body to be exposed to the enemy's fire. In addition to the preceding considerations, the recoil is less violent; and owing to the simpler and more delicate motion of the trigger, there is much less to prevent a correct aim, so that a very accurate fire is the consequence.

The objections which have hitherto been imagined are, the liability of the spring to get out of order, the divergence to the right or left to which the steel needle may be liable in passing through the powder, and the probability of missing fire when the needle gets dirty; likewise the escape of gas through the apertures, after firing has been continued for any length of time; and finally, the wear and tear of the barrel, from the smoke and burnt powder issuing through the apertures at the place of junction of the cylinder with the barrel.

That some imperfections should exist may be expected, as inseparable from the works of man, but they should, in this case, be considered in comparison with the advantages, and possible effect of such an instrument on modern warfare.

The diminished power of the spring by constant use, and the divergency which may be caused to the needle, are serious, but it is hoped not irremediable evils, since both spring and needle may be renewed at a trifling expense. By having a few spare needles and springs, as one of each for eight or ten muskets, or in any other proportion that may ultimately appear desirable, the defects in question would probably be remedied, and efficiency secured; for the liability of the piece to miss fire, and the more serious defect of the escape of gas, only take place (extensively, at least, in the latter case) after some fifty or eighty discharges, so that a general action might be fought before the piece even requires to be cleaned. It is true that the gas escaped with sufficient force to remove a trifling weight placed on the aperture, but this should not be a fatal objection to an instrument of undoubted power and precision of range. Even from a piece with a flintlock, the escape through the vent is considerable, and at any rate the evil may be lessened if not entirely removed; for since American and other pieces have close fitting breeches, as was shown lately at the Great Exhibition, it cannot be doubted that the skill of our workmen will overcome the difficulty in the case of the Prussian musket.

The breech loading musket has been partially used, and it is understood with good effect, during the late Hungarian war, and still more decisively in the north of Germany.

In one part of the hard-fought battle of Ilstedt, the Danes found themselves opposed by skirmishers armed with the new Prussian musket. "The enemy," says the Danish Commander-in-Chief, Krogh, "under cover of a bridge, fired with pointed balls (spitzkugeln), at a distance of 100 and 150 yards. It was in vain that a couple of guns threw shells at a short range among the skirmishers; it was in vain that a body of cavalry made their several attacks; it was in vain that the endeavour was made to bring up the infantry from Oberstolk, which was now in flames, while a fierce engagement was going on in it from the house windows, and the streets. In less than an hour we suffered a great loss. The brave General Schleppegrell fell mortally wounded during the attacks; the chief of his staff, Lieutenant Colonel Bulow, was severely wounded; the commander of the battery, Colonel Baggeilsen, was made prisoner, and two of his guns taken by the enemy. Several other officers were also killed, among them Lieutenant Carstensea, whilst endeavouring to rescue Captain Baggensen, and about 70 subalterns and privates. At least 90 horses were killed or taken."

The efficiency of this weapon is now, however, being put to the test by a committee appointed by the Commander-in-chief, by whom the French and a variety of other muskets are being carefully examined. Amongst the number, the patent needle gun of Sears, and the rifle invented by Mr. Lancaster, may be mentioned. The former loads at the breech and partly resembles the Prussian musket, but has in addition a receptacle containing fifty detonating caps, which, by a simple operation, are brought forward successively to ignite so many charges. The following brief description will give some idea of the construction of the latter weapon, which is simpler than the Prussian musket, though giving, it is said, an equal range.

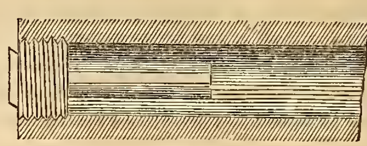


Fig. 1 A.

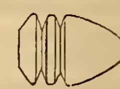


Fig. 1.

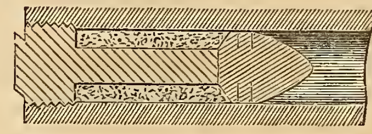


Fig. 2 A.

Fig. 2.

Figure 1 represents the ball before it is put into the piece. The rings, which will be perceived round the lower part, permit the compression of the ball, which, on being forced down by the ramrod, assumes more completely the form of the inside of the barrel.

Figure 1 A shows the breech-end of the barrel, with the metal pin forming part of it.

Figure 2 shows the shape of the ball when its rings are compressed by being rammed home, so as to form a solid ball.

Figure 2 A shows the position of the ball prior to its being compressed by the motion of the ramrod, and with the powder lying round the pin, on which the former rests.

As the new musket, whether loading at the breech or at the muzzle, gives a more distant and a more accurate fire than is ever attained even by our best rifles, it can scarcely be doubted that in one, if not in both, of these two forms the new weapon will be adopted in the British army, but whether of the English or of the smaller calibre of the French, requires much serious consideration. There does not seem to be any doubt that an extreme range, with great power, belongs to both; and the weight saved to the soldier by sixty rounds of light balls is an object of paramount importance. As much more depends on rapidity of movements than on carrying a quantity of ammunition into action, the consumption of the great battles fought during the last war would be a safe guide. It is understood that the number of rounds fired has varied from three to about twelve. In the three days ending with Waterloo, the number of rounds fired amounted to 987,000, which, for the number of men under arms, would be from 10 to 12 each; 30 rounds, therefore, would appear to be ample for the soldier to carry, and 20 additional rounds, on an average, might accompany the army in light waggons.

Besides a more distant execution and other advantages claimed for the new fire-arm, especially for the Prussian pattern, its advocates do not hesitate to affirm, that its fire will be more formidable than that of grape-shot; that the gunners would be picked off at such a distance as to make it impossible for them to serve the guns in face of light infantry, and that it will, in consequence, supersede the use of light artillery. It is also alleged that personal conflicts, such as line against line, or column against column, will cease altogether, and future battles be decided by the effects of a rapid and destructive fire, in the precision of which, rather than on personal contact and extensive combinations, the result will depend.

Since a single man can now be struck down by a musket ball at a considerable distance, it follows that the means of defending fieldworks, a river, a defile, or, in fact, any strong post where the defenders can

remain under cover, whilst the attacking force is exposed, will be greatly increased. In such cases, more particularly in that of a fortress, the defence will probably become superior to the attack, at least after such modifications in the construction of fortresses shall have taken place as will give longer lines of defence, protected by a loop-holed musketry fire from those parts of the works which, in this respect, have been hitherto rather neglected.

THE IRISH DIFFICULTY AND ITS SOLUTION.

BEET ROOT SUGAR.

(Continued from page 48.)

THE objectors to Beet sugar have still another card to play, and we must indulge them. In the year 1854 the differential duties against slave grown sugar will cease, and it will enter the market on the same terms as that from our colonies. Will Beet sugar, deprived of protection, pay *then?* Professor Sullivan (in *The Manufacture of Beet root sugar in Ireland.* Second edition. Dublin: McGlashan), says it will, and we agree with him. An abstract of his pamphlet, which cannot be too highly commended for its dispassionate tone and lucid style, will put our readers in possession of the facts of the case.

Duty or no duty, the Beet sugar manufacturer has a never failing natural "protection" of £6 to £7 per ton, which is made up of the following items:—Freight from the West Indies £4 to £5 per ton; loss from drainage £1 per ton. (This *ought* to be avoided, and *will* be, some of these days. It must not, therefore, be permanently reckoned on.) Port dues, sea insurance, consolidated rate and landing charges, £1 4*s.* to £1 7*s.*, say a total of £6 to £7, from which the home producer is exempt.

Next, as to cost of labour. Professor Sullivan "thinks too much importance is given to slave labour, and that, on close examination, it will be found that it is not cheaper than the same amount of free labour would be in any of the European countries. It is, of course, cheaper than free labour in the emancipated colonies, simply, because, under a warm sun, the free negro prefers very naturally demanding a high price for a small amount of labour, because he is certain of obtaining it, in consequence of the great demand for labourers and the limited supply." This is true, but does not contain the whole point of the question. The difficulty in the West Indies is, that labour is not only scarce, but the few labourers there are cannot be depended on. And, the sugar crop requires a vigorous exertion at the critical moment to ensure success, which nothing but the slave driver's whip seems able to extort from the African race. Slavery, however, in its present form, cannot exist much longer, either in Cuba or Brazil, but it would indeed be curious if the final blow at our sugar colonies came from Ireland.

In the case of beet sugar, it is not slave labour *versus* free African labour, but *versus* a cheap and inexhaustible supply of skilled European labour. Professor Sullivan reduces it to figures, thus:—An acre of sugar cane requires double the labour which an acre of beet does. In Europe one-half a labourer's wages are expended in food—granting, then, that food is only one-half the price in a tropical climate (which is giving it the advantage), the slave owner is still only on an equality with the European, because he has to provide food for double the number of labourers. "The European labourer has the remaining half of his wages to provide clothes, rent, &c., and the slave-owner has to provide clothes, lodging, fuel for cooking, and, in addition to this, he has the capital embarked in the price of his slaves, which is lost every time the slave dies, &c. &c. Now, suppose all these expenses to be only one-half what the European labourer has for clothes, &c., the slave-owner, having to pay for double the number, would, in this case also, be merely on an equality with the free European labourer." And, further, in an estimate of the profit (see p. 47), Professor Sullivan has taken the price of fine sugar at 28*s.* per cwt., which is below the present price of foreign refined by 3*s.* 4*d.* per cwt. "The last objection raised against the Beet sugar manufacture is, that owing to the peculiar taste of the Beet, all sugars made from it must be refined; and that as the greater part of the sugar consumed in these countries is employed in the state of raw sugar, the manufacture of Beet sugar must be confined to the supply of a part of the limited demand for refined sugar, in which there will be active competition. The answer to this objection may be given in a few words. Soft sugars equal to foreign, and quite free from the peculiar taste of the Beet, can uow be made by the newly patented process." We can answer for the quality of a specimen of refined white sugar, which has been obligingly forwarded to us by Mr. Gwynn. On the other point we hope to satisfy ourselves very shortly.

Professor Sullivan also discusses the effect of the growth of Beet in an agricultural point of view. Green crops are indispensable in good farming to alternate with white; ordinary green crops require cattle to consume them and convert them into manure; but cattle require capital to purchase them and more to shelter them. Therefore, good farming requires capital. But suppose the capital cannot be had, what then? Beet offers a mitigation of the want. It will take the place of turnips in the rotation of crops, and produce food for man instead of for beast. And yet it must not be forgotten that this expedient does but shift the difficulty instead of meeting it. Capital must still be forthcoming to build sugar factories, but the great end is gained, that instead of the capital being frittered amongst a number of individuals of whom but a few would turn it to good account, it would be concentrated under good management, and distribute its blessings to all who had industry and energy to avail themselves of its benefits.

The meteorological conditions necessary to success are also important and demand attention. That the production of corn has been pushed beyond its due limits in this country, under the "hot-bed influence" of protection, cannot be doubted; and the same law applies with even greater force to Ireland, as we shall proceed to show. Wheat requires not so much a high temperature on the average as just at the period of ripening, when warmth, absence of moisture, and abundance of light are necessary to the full development of the seed. "Thus, for instance, while the French wheat is readily reduced to a soft impalpable flour, without any feeling of grittiness, which renders it so well adapted for pastry, the Odessa wheat has a sort of horny starch, which gives the flour an extremely coarse and gritty feel." A table of temperatures and rain-fall readily explains the cause. It may surprise many of our readers to hear that *both the mean annual and mean summer and autumn temperature of Cork are sensibly higher than those of Paris.* But, whilst in England and in the North West of France there are only 38 to 39 rainy days in the months of August, September, and October, there are in the South and West of Ireland, 69, in the same months. Thus, the cooling effects of evaporation and the overcasting of the sky, turn the balance strongly against us.

Professor Sullivan then proceeds to show that these circumstances are favourable to the production of sugar and sap, as strong light is to the production of highly developed seed. Thus, while the average produce per acre of Beet in Ireland is 14 tons in an unfavourable, and 15 tons in a favourable year, the general average in France is only 10.89 tons. Mr. Sullivan, however, admits, further on, that "none but good farmers ever think of growing Beet" [in Ireland], and, consequently, it may not be a perfectly fair average *at present,* although 30 tons can be obtained from well manured land.

The following analysis of the saline matters in the produce of an acre will be found interesting:—

"Fifteeu tons of Beet contain about 317lbs. of saline matter; and four and a half tons of tops, about 220lbs. These quantities contain of

	Roots.	£	s.	d.	Tops.	£	s.	d.
Potash	155 lbs., at 2*d.* per lb.,	1	5	10	75lbs.	0	12	6
Soda .. .. .. / Hydrochloric acid ..	48½ lbs. of salt, ..	0	1	0				
Lime	28lbs...	0	0	0	40lbs.	0	0	0
Magnesia	17½lbs. at 1*d.* per lb.,	0	1	5½	7lbs.	0	0	7
Phosphoric acid ..	24lbs., at 1½*d.* per lb.,	0	3	0	20½lbs.	0	2	7
Sulphuric acid ..	6⅓lbs., at ¾*d.* per lb.	0	0	4¾	5lbs.	0	0	4
Soluble silica.. ..	20½lbs., ...	0	0	0	2lbs.	0	0	0
Making, with the other ingredients, a total of	317lbs.,	£1	11	8¼	220lbs.	0	16	0

The inorganic matter thus abstracted from the soil must be returned to it in the shape of manure, which, as the system supposes the production of but a small quantity of farm-yard manure, must be artificial manure, the continued use of which, alone, would not maintain the mechanical condition of the land. This, Professor Sullivan suggests, could be effected by ploughing in the tops of a crop of beet occasionally.

In our next number we propose to give some account of the Beet sugar works on the continent. We may take occasion here to observe that the works of the Irish Beet Sugar Company, at Mount Mellick, are in full operation. They commenced work on the 11th inst., and are now converting 300 tons of roots into sugar weekly. They will have to use green roots for the next two months, at the end of which time they will be supplied with dry roots from the Company's desiccating works at Donoughmore. We are informed that with all the disadvantages attending the use of new machinery and new hands, the cost of labour is only about £7 5*s.* per ton of sugar, whilst the per centage is 7½.

(To be continued.)

NOTES BY A PRACTICAL CHEMIST.

Picric Acid as a Yellow Colouring Matter.—M. Guinon, of Lyons, has succeeded in dyeing silk light and medium yellows, from sulphur to light citron, by means of this acid. His attention was first directed to the subject by observing the yellow colour which it communicates to the skin. This acid has been known under various names, such as *Welter's bitter, bitter yellow, indigo bitter, carbazotic acid,* &c. It is produced by the reaction of nitric acid upon a variety of organic substances, such as indigo, aloes, silk, tar, oil of coal. Its empirical formula is C^{24}, H^{6}, N^{6}, O^{14}. Guinon's process for obtaining it on the large scale is as follows:—Into an earthen pan, able to hold three times the quantity actually employed, are put three parts commercial nitric acid at 36° and heated to 140° Fahrenheit. The vessel is then removed from the fire, and 1 part oil of coal gradually added through an earthen tube, tapering at its lower extremity, which dips into the acid. Each portion of oil, on entering the vessel, causes a violent reaction, heat being generated, and carbonic acid and nitric oxide given off. Should the liquid threaten to run over, the addition of oil is suspended, and the whole cooled with a little cold nitric acid. When all the oil has been thus poured in, the greater part is already converted into picric acid, but a portion yet remains as a red, resinous mass. Three parts more of nitric acid are therefore added; the liquid boiled, and evaporated to a syrup. Care must be taken not to let it dry, as it would then ignite with violence. The syrup thus formed solidifies, on cooling, to a yellow paste, weighing about one-sixth of the materials employed. This consists of picric acid, nitric acid, and a little resin. The picric acid is extracted by boiling the mass in water, when it is dissolved, and redeposited in crystals on cooling. It may be further purified by repeated crystallization; but if demanded in a state of absolute purity, it must be combined with a base, such as ammonia, and precipitated with hydrochloric acid. Silk mordanted with a mixture of alum and cream of tartar takes a fine straw yellow from solution of picric acid. It may be washed several times, but is discharged by weak acids, alcalies, and chloride of lime. It is not affected by exposure to the sun and air. Wool takes a more intense tint than silk, a fine citron yellow: 3.73 grammes of picric acid give this shade to 1 kilogramme of wool. If a mordant of alum and cream of tartar has been previously applied, the colour resists washing and the action of sun and air, but is, nevertheless, discharged by chemical agents. Cotton, whether mordanted or not, is not coloured by picric acid.

Test for Mercury.—Mr. Morgan states that if a strong solution of the iodide of potassium be added to a small portion of any mercurial salt, placed upon a clean bright plate of copper, the mercury is immediately reduced, and forms a silvery stain upon the copper. This reaction is decisive, as no other metal is deposited by the same means. By this method corrosive sublimate may be detected in a solution which is not acted on by caustic potassa or iodide of potassium. In a mixture of 1 grain calomel with 200 grains sugar, one grain produces a distinct metallic stain, which of course contains $\frac{1}{200}$th of a grain of calomel. $\frac{1}{400}$th red oxide of mercury may be detected in the same manner. Although this test acts on minute quantities, still they must be in a concentrated state.

New Source of Chloroform.—If 600 parts water, 200 parts chloride of lime, and 25 parts oil of turpentine are well mixed in a retort and distilled, a violent reaction takes place, carbonic acid gas being liberated in great abundance. As soon as the mixture begins to rise, the retort is withdrawn from the fire, and the process goes on to the end without the application of external heat. The receiver is found to contain three layers of liquid, the undermost having a scent of chloroform. It is separated from the higher liquids by means of a pipette, rectified, and redistilled over chloride of calcium. The product presents the usual composition and properties of chloroform. The author (J. Chantard) has no doubt that by some similar process chloroform might be prepared at a much lower price than is the case with our present methods.

Artificial Preparation of the Flavouring Matters of Fruits.—One of the most remarkable and interesting achievements of chemistry in the most recent times has been the preparation of certain liquids possessing the flavours of various fruits. So close indeed is the resemblance that we are almost warranted in supposing the flavour of the fruits to be actually caused by the presence of a trace of the above liquids. Several of these articles are employed in confectionary, and are manufactured on a tolerably large scale. The acetate of amylic oxide, when dissolved in six times its bulk of alcohol, emits a most powerful and agreeable odour of Jargonelle pears, and is used in flavouring *pear-drops*. The valerate of amyle, dissolved in alcohol, gives the scent and flavour of apples. Butyric ether communicates the flavour of the pine-apple, and is used in the preparation of various beverages. Various other compounds of the so-called fatty acids, with the oxides of amyle and ethyle, possess very pleasing odours, and as they can be prepared at a reasonable price, may probably admit of extensive application in perfumery.

ANSWERS TO CORRESPONDENTS.

"Practicus" feels aggrieved at our strictures on the washing powders, and accuses us of "prejudging the question on theoretical grounds." We can assure him that we are nowise desirous to "chill the ardour of inventors" by pronouncing any desirable object unattainable; but knowing the conditions of the problem, we must certainly view it as difficult, whilst from our own experiments, and the testimony of our friends, we are led to conclude that it has not yet been solved. We must remind "Practicus" that in the laboratory, washing is a very frequent operation, and though the surfaces we ordinarily require to cleanse (glass, porcelain, &c.) from their smooth surface and close tex-

ture, afford very little hold to dirt, and though we can apply the most powerful acids at a high temperature, we yet find it impossible to dispense with the use of friction. How much more then will friction be necessary in cleansing substances of a rough surface and open texture in whose interstices the dirt can lie entangled. Those who profess to supersede mechanical labour in washing have to perform the following task:—To find a liquid able rapidly to dissolve every species of dirt and stain likely to occur on articles of dress, &c., yet at the same time incapable of injuring the fibre of cotton, linen, wool, or silk. If "Practicus" thinks he has succeeded, let him forward us a sample of his "powder," and if it stand the test, we will be the first to proclaim its virtues.

"A Dyer."—Tartaric acid is obtained from crude tartar (tartrate of potash) deposited from the juice of grapes. A *cheap* artificial source is one of the great desiderata of the chemical arts.

"R. Z."—Iodine is by no means so rare a body as was formerly supposed. It occurs, although in small quantities, in the water of many, if not most, springs and rivers. As regards your second question we must refer you to some medical paper.

"Falmouth."—We have seen the article to which you allude, but think, for our own part, more conclusive evidence necessary before we can admit that the silver was actually *formed*, as the writer imagines. That journal, you will observe, is the authorized channel for all scientific *heresies*.

S.

THE HOLMFIRTH RESERVOIR.

Report of Captain Moody, R.E.

The immediate cause of the late catastrophe was, the middle portion of the dam at the Bilberry Reservoir being lower than the top of the waste-pit. This waste-pit was designed to carry off the waste or flood water; but the top of the embankment having sunk below the top of the pit, and being suffered to remain so, the flood waters had no proper or sufficient escape; but went over the dam, which, as a necessary consequence, gave way. In the evidence before you, mention has been made of a spring, of different leaks, and of defective workmanship; but so long as the level of the dam was below the level of the waste-pit, and the flood suffered to pour over the top of an embankment of this kind, it would give way, though there were no springs, no leaks, and though the best quality of puddling was put in as water-tight as possible. It would give way, though not so simultaneously, from top to bottom. It would be slower in its operation; but still quick enough to form a flood of terribly-destructive effect in its course. To enable the jury clearly to apprehend the force of all the facts of the case bearing directly on all the engineering parts of the question, it is necessary first to give some idea of the principles on which these kinds of dams are designed, and how they are carried out. This I will do in as few words as possible, and equally concisely offer a few observations on the design of this reservoir and dam in particular; and draw your attention to the evidence given as to the manner in which that design was executed. In constructing a reservoir of the nature of the one at Bilberry, the site being fixed upon, the extent of area of the district, the surface water from off which will be drained into it, is ascertained. Calculations are also made from the most authentic records of the quantity of rain that falls upon and flows off this area in a given time, both on ordinary occasions and what may be expected in times of flood. In these calculations, allowance is made for absorption and evaporation. The capacity of the reservoir when full, is estimated from levels taken at different depths. To impound the water, an embankment is formed across the ravine or valley, to the height that will contain the greatest quantity of water at a reasonably economical outlay. The supply of water which may be needed for the manufacturers, or other uses, and for which the reservoir is constructed, is led away from the interior portion, nearly at the bottom, by what may be called supply pipes, or enclosed channels, constructed of metal or masonry, according to the size. The quantity of water to be discharged is regulated by sliding valves (called here "shuttles"), working in these, or at the extremities of these pipes. The sliding valves in this case work vertically, and are placed one behind the other at no great distance, and in the same pipe, so that the water passes through the opening on both sides; and if either get fixed by accident or injury when down, the passage of the water is stopped, and the reservoir must necessarily fill, rendering it a difficult operation to get at the slide to rectify it, besides losing the use or service of the water. It must be understood distinctly, and borne in mind always, that these channels or pipes are solely for the ordinary supply of water for the economical purposes alluded to, and for these alone. Their capacity is regulated accordingly. They should be protected from anything but water pressing upon or passing through, and this is generally done by iron gratings, removed to a little distance, and so designed that though obstructions may be intercepted and for a time rest against them, there shall be space for the requisite supply of water to get into the pipes and through the slides. To carry off the waste water, and the floods that may fall on the drainage area, other arrangements are made. In the case before you, a circular pit of masonry was built up in the body of the embankment on the inner side. The ordinary supply pipes passed into the bottom of the pit, and a nearly horizontal culvert was constructed, to convey away from the bottom of the pit the water coming through the ordinary supply pipes, as well as any waste or flood water flowing down into the pit. The culverts lead to a goit for the supply of mills down the valley. When these waste pits are adopted, I need scarcely impress upon you, that they are so designed in height and capacity, and the culvert also in capacity, that the flood or waste water shall freely fall down the pit, and pass off through the culvert in sufficient quantities to prevent the water in the reservoir ever rising to the height of the top of the dam. The position of the entrance to the supply pipes and the plan for carrying off the flood waters at Bilberry, are, I understand, very common in this part of the country; but I would not counsel their adoption in such sites as the one in which this is situated, high up in a hilly district, at the junction of two deep ravines, with precipitous sides, and rapid descent from above. Obstructions of various kinds may be expected to be continually brought down, particularly in heavy floods of rain. They would be drawn by the set of the current towards the pit, and may impede the escape of the flood waters in a sufficient volume, by getting into the waste-pit and choking up the passage. Even if there was a grating over the waste-pit they would be gathered about it, and, by the downward suction, be kept upon it. It is stated in evidence, that a tree once passed into the sliding valve, and there remained fixed. When I caused the water remaining in the reservoir, after the "burst," to be drawn off, a large stone was jammed against the entrance of the supply pipe, and the whole bed of the swallow is deep in mud; and wreck, peat, ling, and stones close up to the sliding valve. Some arrangement at the entrance of the swallow to prevent this is always advisable, in addition to a proper description of grating in front of the valve. I would prefer the byewash, which is in more general use. It consists of a notch, as it were, cut out at one or both ends at the top of the embankment. Through this notch the surplus water passes, and is conveyed away along the side of the valley, in a broad open ditch or canal, to a safe distance, and then emptied into the valley lower down, if allowed to run to waste. Obstructions getting into the byewash could be removed with more facility, certainty, and expedition. It is also possible to widen the channel on the side of the natural ground in some cases, and greater room made for escape on any occasion quite beyond human foresight. I think it will be more convenient to you, if, before I proceed to allude to the embankment, I

connect the foregoing observations to this particular case. I estimate the drainage area for Bilberry reservoir at 1,920 acres, shown on the accompanying portion of the ordnance survey. The space drained is coloured red. I find it very difficult to get good data for estimating the quantity of rain that passed off the surface. Very careful records are kept at Woodhead, in the valley at the other side of the hill range, where Mr. Bateman is constructing a series of reservoirs for Manchester. By the kindness of Mr. Bateman, I have had access to these records; and, calculating from them, and supposing equal quantities of rain to have fallen on both sides of the hill on the day and night of the 4th instant, 1,920 acres would have given a supply of 500 cubic feet per second. I am under the impression, however, that a considerably greater quantity must have fallen on this side of the range at that particular time. Taking the evidence of those who were watching the rising of the flood at the embankment, it would appear that from five o'clock it rose at the rate of about one foot per hour up to half past eleven. In this quantity of water I would include the smaller quantities going through the slide valves and leaks. Suppose in the calculations that, in consequence of the large stone against the valve, only one-fifth did go through to what would have gone through had it been free. The waste-pit is circular, 12 feet in diameter in the clear; the depth to the bottom of the culvert is 59 feet; the side valves are at the bottom, and 11 inches in the clear; the space between them is two feet square, and 6 in length. The culvert is 6 feet 4 inches high, and 6 feet 6 inches wide, semicircular at the top, with perpendicular sides, and is 180 feet in length. The sectional area of the waste pit is 113 square feet; that of the culvert 35 feet 4 inches; that of the slide valves 1 foot 7 inches. From these dimensions, with the pressure due to the whole height, the culvert has capacity to discharge about 1,500 cubic feet per second. The quantity coming into the reservoir is assumed above at 500 cubic feet, so that proper allowance has been made for its escape had the waste-pit been so circumstanced as to fulfil the object designed in its construction. I will now proceed to make observations on the dam. The water is impounded in the reservoir by an earthen dam across the valley. The one which has been adopted in this case is of a common construction, and perhaps the most economical. It is formed of a wall of puddle, thick, with a mass of earth on either side. The puddle is 16 feet thick at bottom, and 8 feet at top; the inner slope of the earth has a base of three to one; the outer slope a base of two to one. The length of the dam is 340 feet, and was carried up to 98 feet high, according to the original design. This mass, or rather that part of it on the outside, including the puddle, acts by its weight, which should more than counterbalance the pressure or height of water acting against it. The object of the puddle wall is simply to prevent the water getting through to the outer portion. It is to keep the whole water-tight, and is not to be considered as having any strength in itself. Such a dam answers extremely well, if the materials are carefully selected, and the whole work well executed. The heavier portion of the material (the heavier the better the stones be) should be placed on the outside, and the more binding materials on the inside. Close also to the puddle dam or wall, on both sides, the material should be very binding in its quality, and well rammed—the nearer it approaches to the effect of puddle the better. In the construction of the Bilberry dam, this careful selection has not been made. The material is similar on both sides, and loose in its nature. The inner portion is permeable throughout, and instead of the part next to the puddle dam being closely rammed, and almost puddle in its character, a dry, open, rubble wall, or backing appears to be carried up from the bottom on both sides of the puddle dam, inviting the water, as it were, to act on the whole inner surface of the puddle, to escape with greater ease at any leaks or fissures arising from the settlement or bad execution of the work. In flowing over the top of the dam (which it ought not to have done if the waste pit was in a position to act) the water would flow down through this dry rubble to the very bottom, and, acting on any cavities, or porous or weak portions, at that part of the embankment, would act with immense hydraulic pressure—in fact, on the principle of an hydraulic ram. In the case before us, you have it in evidence that the water, before passing over the outer surface of the dam, did pour down thus for half an hour; and also acting on the water, which was forcing its way through the leaks, and a spring at the bottom, the dam boiled up in the centre, as the witness states, and burst out from the bottom almost simultaneously with the breaking away of masses from the top. It was thus the whole dam gave way, and the volume of water in the reservoir burst forth at once. The construction and material of the earthwork in the slopework of the dam, are comparatively of minor importance to the puddle, or the centre. The trench extending down the sides and bottom of the valley to receive the ends and base of the puddle, should, as the specification before you provides, go down to the solid rock, or impervious strata. All springs should be carefully led away, and even every fissure got past or through until all is safe, firm, and solid, clear of water, or what might be channels for it, when the reservoir is filled, after the completion of the work. This observation applies equally to the sides as well as to the bottom. In executing this it sometimes happens that very heavy and quite unforeseen expenses have to be incurred. The excavations are sometimes obliged to be extremely great in depth, and if the rocks are shaky or open in their stratification at the sides, it may be found necessary to puddle all over the ends or junction of the dam with the sides of the valley. It may be necessary to puddle part of the sides of the reservoir itself. In short, no care can be too great, and no expense should be withheld, to make all perfectly water-tight. Leakages or springs are continuous, and continuously injurious, reaching eventually perhaps to very heavy expenses, if not to disastrous effects. The puddle should also be of the best quality; but puddle should always be excellent. There are different opinions as to the best mixture. In this instance gravel and clay were mixed together, and it is unequal, though what is now seen in the embankment may be considered good. You have evidence of much which we cannot at present see being bad, and the effects which are to be observed seem to confirm that evidence. To be water tight, and not liable to crack or settle unequally, are the conditions good puddle should fulfil. The trench to receive the puddle wall at Bilberry dam was cut down to a depth of nine feet in the centre, in consequence of coming on a soft place at that depth. It appears that a very strong spring was tapped at the lower strata of shale. The section before you shows the stratification of the rocks (millstone grit and shale), and from the dip it will be seen that water might be expected to rise where it did rise. The stratifications of the rocks immediately above the dam are full of fissures, and very shaky. From the runs showing themselves lower down than the dam, and the leaks at each end of the dam, when there was much water in the reservoir, it is to be inferred that the openness of the strata was not sufficiently regarded. It appears in evidence, that the spring at the bottom of the puddle trench was not led away by any of the usual modes. I think it proper to observe, that the expense of doing this would have to be borne by the contractors. It, however, was not done, but very objectionable plans resorted to, in the hope of choking it up, or "weighting it down," to use the words of the evidence. But it was not to be weighted down; it rose as the work rose, materially injuring the lower portion of the puddle, making it weak and bad, of a nature easily to be worked away with the water of the spring, as the latter forced itself through the outer part of the embankment, like a little rill of water issuing from the foot. At times this rill was clear, at times muddy and yellow. The muddiness varied with the head of water in the reservoir. To the weak nature of the

puddle at the base, and the washing away, from time to time, by the continuous run of water from the spring under the bottom of it, the great settlement of the puddle dam in the centre is to be attributed—a settlement which continued to go on during the construction and after the dam had been raised to the height required in the specification. Of late years the settling down appears to have gradually ceased. Doubtless the soft puddle had nearly been all squeezed out, and then would commence a different mode of action; leaks increasing in size, and unequal settlement, causing fractures. The formation of pits or craters along the top of the embankment admits of speculation as to this cause. It is not a matter of certainty. The lowest points of the pits now remaining are exactly at the edge of the puddle dam, and immediately over the dry rubble backing described before; in one instance the lowest point is at the inner edge: and in the other at the outer edge of the puddle dam. They might have been formed at the time of the high water or freshet, alluded to in the evidence, and which filled the reservoir soon after its completion. At this time it is not unlikely that some water poured over the edge of the puddle-dam into the dry rubble backing, carrying with it some of the earth, and leaving a crater-like formation. At the time of the catastrophe, it poured down into this portion at the centre of the dam for half-an-hour. At the time to which I am alluding, it might have been only for a very short period. I am induced to think they must have been formed at an early period, when the bank was at its full height, because there is a similar formation on the right flank of the dam, at an elevation above the level of the top of the waste-pit. The top of the dam, near the centre, but close to the little crater or pit, has sunk bodily, all across, and on the sunken part is a larger crater, formed, I conceive, at the same time as the higher one. Both are shown in the plans and sections before you. The sunken part is over the culvert, and is no doubt due to the washing away of the bad puddling over and above the culvert, where it passes through the puddle wall below. This bad work, and the fruitless attempts to remedy it, are detailed abundantly in the evidence you have had before you. That evidence does not bear directly on the bursting of the dam, but proves the inferior execution, the misunderstandings, and faulty management and control that have marked the whole construction of the dam. From the description of a leak half-way up the middle of the dam, as well as the great depth and width of the centre-pit, as described in evidence, but now washed away, I would infer, it is probable the puddle was shaky at this part, and had some fissure near the upper portion, through which the water leaked when the head of the water was high. The shakiness would be caused of late by the continual wearing of the spring beneath. I will not take up more of your time by alluding to other points that attracted my notice. I will just observe, they will simply serve to show, in addition to what I have already stated, that the execution of the work was not what it ought to have been; and bad execution in works of this kind, or any works connected with water, is fatal. The works must be good, and water-tight, or they will be dangerous, and their destruction must come sooner or later. In the evidence, there appears to have been much stress laid on the great cost of the reservoir. I think it, therefore, right to observe to you, that in hydraulic engineering generally, it is extremely difficult, if not impracticable, to say with certainty what the final cost may be. It has been shown in evidence that eminent engineers have tendered estimates of different amounts to put the reservoir in an efficient and safe condition; the plan proposed being to cover the inner slopes of the dam with puddling, and to re-pitch it with stones; also to puddle a portion of the sides, and thus make it, if possible, water-tight. Still, if that had been done, it might not have answered, so long as that full spring existed where it was, and unknown to the engineer, also runs of water round the flanks of the dam. They might have had to execute other works, and incur other expenses. I am speaking of really eminent men, skilled in their profession, and well knowing what they were proposing. I do not mean unprofessional men, who are unskilled, who do not know what they are proposing, and had better, much better, leave hydraulic engineering, and all engineering, to engineers. I conceive it quite possible it might have been necessary to extend the puddling and pitching far up the sides of the valley, making it almost like a tank. It might have been necessary to do this. The stratification is extremely full of fissures and shakes. In this neighbourhood there are many mountain reservoirs receiving floods of water impounded by lofty dams. Pray don't look upon them and treat them like mill dams or fish ponds. They are engines of mighty force, strong in aid of your industry to augment your wealth, and terrible in their power to destroy if mismanaged or neglected. This fact must be indelibly impressed on the minds of all the dwellers in Holmfirth.

VERDICT OF THE JURY.

The jury retired to consider their verdict at a few minutes before two o'clock, and were absent till five minutes past four, when the foreman handed in the following verdict, to which 15 of the 16 jurors had agreed—Mr. Martin being the only dissentient:—"We find that Marsden came to her death by drowning, caused by the bursting of the Bilberry Reservoir. We also find that the Bilberry Reservoir was defective in its original construction, and that the commissioners, engineer, and overlookers, were greatly culpable in not seeing to the proper regulation of the works; and we also find that the commissioners, in permitting the Bilberry Reservoir to remain for several years in a dangerous state, with a full knowledge thereof, and not lowering the waste pit, have been guilty of wilful and culpable negligence, and we regret that the reservoir being under the management of the corporation prevents us bringing in a verdict of manslaughter, as we are convinced that the gross and culpable negligence of the commissioners would have subjected them to such a verdict, had they been in the position of a private individual or a firm. We also hope that the legislature will take into its most serious consideration the propriety of making provision for the protection of the lives and properties of Her Majesty's subjects exposed to danger from reservoirs, placed by corporations in situations similar to those under the charge of the Holme Reservoir commissioners."

The Coroner said Captain Moody, the government engineer, had inspected one of the other reservoirs—the Holm Stye Reservoir—and would express an opinion as to its present state.

Captain Moody, R.E., said he had been requested to make a few observations as to the state of the Holm Stye Reservoir. He had inspected it, and it appeared to him that they ought not to delay sending for some superior engineer, well acquainted with this kind of work; take his advice; carry it into execution; not thinking too much about making an economical bargain. Recollect what he told them about gratings. There was one in this reservoir, but not of good design. It was vertical, and a little within the channel. It might, therefore, get choked up, and the ordinary supply of water not pass through it. There was also the same arrangement of slide valves, so that if either got fixed, the water could not get through it, and the reservoir must fill. Then, although the valve was up, there was a considerable leak in it. There was also a considerable leak outside the masonry of the culvert, and the water was running, by a stop watch, at the rate of sixteen inches per second. The water, when he saw it, was running very muddy. He watched it a considerable time, in company with two brother officers. But this evil was not so great as another. They would remember how strongly he impressed upon them the necessity of allowing the waste and flood waters escaping freely, and he recollected that he recommended that there should be a byewash. In this reservoir there had been a byewash, but when he went up there was a wall built across it, well puddled down to the bottom, and had the water

risen on the 4th February a few feet higher, there could be no doubt but this reservoir would have gone also, and they would have had a flood down the valley of Ribblesden, meeting that down the valley of the Holme at right angles at the entrance of the town, and the destruction of life and property would have been much more awful than it was. (Great sensation.) He assured them when he saw the wall built across the byewash, he said "these people are insane!" He could not have believed it if he had not seen it, that sensible men, millowners, having property in the way, could have acted so insanely. He instantly ordered it to be removed. (Great applause.) He did not pretend to tell them what were the remedies to be applied: let them, or rather the commissioners, send for a hydraulic engineer, and take his advice. He thought it right also to make an observation about the men in charge of large engines of terrible power, such as those reservoirs. They were not paid enough. They had no right to expect a man to pay attention to one of them with £5 a year salary. They must pay more, and get a good man.

PROGRESS OF AMERICAN INVENTION.

(Continued from p. 60.)

Agriculture.—*Machines for Hulling Grain and Rice, and separating Smut and Dirt.*—Eight patents have been granted; three of these for hulling clover, four for smut machines, and one for separating garlic from wheat. I shall notice three of these machines. The first is for the construction of the basis for setting the teeth on the cylinder of a clover huller, or on the concave of the same. The teeth are first set in a compact sheet of leather, and this fixed upon a basis of cork, for the purpose of rendering the teeth capable of a slight flexibility, so as to prevent breaking from the accidental introduction of stones or other foreign bodies.

A Clover Huller has been patented; the novelty of which consists in the form and arrangement of the teeth on the concave and on the cylinder. The one (say the cylinder,) has teeth proper of an elipsoidal form, running between serpentine ribs of alternate expanded and contracted dimensions on the sides, so that the grain between the roughened sides of the ribs and the roughened sides of the teeth, may receive a sufficient amount of friction to clear it of hulls.

A Garlic Machine has been patented, for the purpose of separating garlic from wheat or other grain. It consists mainly of a horizontal slatted or ribbed cylinder, between whose ribs or slats the pinion teeth of another cylinder are allowed to mesh, and against which they are pressed by a spring with sufficient force to crush the garlic without injuring the wheat. The garlic is thus mashed and made to work its way out of the machine, through the ends of the cylinder.

Straw Cutters.—Ten patents have been granted. Three of these will be noticed—the first belongs to the class of straw machines in which the blade is worked by hand. The point of novelty is in the device of fastening the jointed end of the knife on a spring, so that in working the knife, the slight yield of the spring produces a draw cut in severing the straw.

In the *second* machine noticed in this division, the novelty of the invention consists in so arranging the spirally ribbed feeding rollers and horizontal knife with its edge towards the said rollers, and brought so close to the ribs, that those of the upper roller cut against the upper edge of the knife, while those of the lower roller cut against the lower edge of the knife, and thus the straw that is fed through, is all cut either by the lower or upper edge of the knife.

Under this division of agriculture, there has been patented a *vegetable cutter*, presenting some novelty worthy of mention. The machine in the general consists of a short cylinder lying or supported on its side, and having its cutting apparatus on the upper part of the cylinder over which the hopper is placed. The two edged knives, which have a reciprocating motion in an arc corresponding with the periphery of the cylinder, are hung on arms attached to each end of the axle of the same, and vibrate across and just above the opening in the bottom of the hopper, and perform a cut with both the forward and back stroke.

Chemistry.—*Glucose or Grape Sugar.*—An article under this denomination has been patented; it is a process. The sugar found in rasins and in most acid fruits at maturity, belongs to one kind or species, and is distinguished from cane and maple sugar by being not more than half as sweet as the same weight of the former. It was found many years ago, that if starch were suspended in water, slightly acidulated with an acid, and boiled briskly for some ten hours, the starch would be converted into its own weight of a sugar identical with that found in raisins and other fruits, which fruits are acid in the green state; this product is called *glucose.* The patentee has learned by experiment, that if he boils his starch compound at a higher heat than 212°, he reduces the time required to finish the process, so that what was before done in ten or twelve hours may now be done in six or seven. He mixes 25 bushels of corn meal with 150 gallons of water, at the temperature of 175°, and adds about 25 lbs. of oil of vitrol, and after well stirring the same, adds 50 gallons more of water, and runs the whole into the boiler, lets in steam, and allows the contents to boil under pressure, by adding weight to the safety valve. He continues the boiling until the tincture of iodine no longer indicates the presence of starch in the material. Chalk is now added to neutralize the sulphuric acid, and the solution concentrated to crystallize.

Sugar.—A patent has been granted for a process of refining sugar from the beet or cane, which consists in adding to the cane juice, or beet juice, or to the solution of sugar in water, a quantity of baryta, to form the saccharate of baryta, which is removed from the liquor by mechanical means in the state of magma. The baryta is separated by means of carbonic acid gas forced through it; an insoluble carbonate of baryta is formed and precipitated by adding sufficient water, so that the solution of sugar will be of the strength of 30° Beaumé, from which it may be concentrated to the state suitable for crystallization in the usual way.

Draining Sugars.—This is an improved apparatus on Hurd's machine for draining sugars by centrifugal force, and consists in surrounding the wire gauze cylinder by a steam case, to be supplied with steam, or a fine spray of water, the design of which is to prevent the gumming up of the meshes of the wire gauze, which is liable to occur when the surface of the cylinder is freely exposed to the atmosphere.

Refining of Gold.—Three processes have been patented for separating gold from other metals, or from gold sands, only two of which will be noticed here. As this subject is one of great importance, inasmuch as from present appearances gold is likely to become the chief metallic currency of our laud, I deem these processes of sufficient interest to the public, to give them somewhat in detail.

Most of the native gold brought to the mint for refining, contains silver, from which it must be separated before it can be supplied with the uniform proportion of alloy required by law in gold coin. For this purpose, the process now in use throughout the world, is to melt the gold to be refined previous to coining it, with two or three times its weight of silver. It is then granulated and exposed to the action of hot nitric or sulphuric acid, which dissolves out nearly all the silver, both that in the native metal, and that added by the refiner, and thus leaves the gold in nearly a pure state, and ready to receive the necessary portion of alloy required in the gold coin. It will be seen at a glance, that allowing a million of California gold to weigh 53,250 ounces, or nearly two tons, it would require nearly six tons, and worth about 190,000 dollars, to be kept constantly on hand to work it. The desideratum is, therefore, to find some process of working the gold, by which this great outlay of silver may be prevented, and by which greater celerity may be effected; both of these results, the inventors allege, they have obtained.

In the first, the argentiferous gold is converted into the chloride by the action of nascent nitro-muriatic acid generated by the reaction of sulphuric acid upon a mixture of nitrate of soda and common salt, or by other equivalent means. The silver contained in the native gold, is also converted into the chloride by the same chemical reaction, and it is prevented from incrusting the gold by the more intense affinity, aud the agitation produced by a jet of steam which is constantly being forced into it. The gold is next precipitated in the metallic state upon the chloride of silver, by means of pulverised copperas. After washing the precipitate of gold and chloride of silver, the latter is reduced to the metallic state by the re-action of zinc and dilute sulphuric acid; and subsequently the silver is dissolved out by

means of nitric acid. From the nitrate of silver obtained above, the metal in the pure state is precipitated in the usual way by the reaction of zinc and dilute sulphuric acid.

In the second patent referred to, the design of the invention is to avoid the use of chlorine in the first part of the process. The argentiferous gold is first melted down with zinc or other metal baser than silver, from which alloy the baser metal may be dissolved out by dilute sulphuric or other cheap acid, and the bullion pulverised, or an alloy of great brittleness made, which may be easily crushed or broken down by mechanical means, so as to fit the gold bullion for the direct action of nitric or other acid. The inventor states, that he first mixes the argentiferous gold with twice or three times its weight of zinc, melts and stirs well the alloy, and then granulates the same by pouring it into water. The alloy thus obtained, is next treated in wooden vessels lined with lead, with dilute sulphuric acid, which removes the zinc, and leaves the argentiferous gold in a finely divided pulverulent or spongy state. In this second operation heat is not required, and but little more sulphuric acid than will be necessary to form the sulphate of zinc.

Third. The argentiferous gold thus reduced to a spongy state, and still containing the silver untouched by the re-agents used, is treated with hot nitric or sulphuric acid (the sulphate of zinc having been first entirely removed by washing), by which the silver is entirely removed, and to be obtained in the metallic state as in the former process or in the usual way. Finally, the operation is finished by cupelling the gold or melting it with such fluxes as borax, nitre, &c., and casting it into bars.

Alum, the process of Manufacturing, from the "green sand formation" of New Jersey. It consists in igniting the green sand free from lime and magnesia, stirring it in the mean time and exposing it freely to the air, the object of the exposure being to peroxidize the iron contained—care being taken to avoid carrying the heat so high as to fuse the mass and prevent the action of sulphuric acid upon it. It is next treated by sulphuric acid to dissolve out the potash, and the alumina is added in the requisite proportions to form alum.

Red Oxide of Zinc prepared as a Drier of Paint.—This ore is procured from Sussex County, N. J., is heated and partially converted into the white oxide, and by this means rendered friable, and the foreign matters are thus easily separated from it. It is then exposed to the action of the oil as other driers.

Manufacture of India Rubber.—Two patents for improvements in the manufacture of *India Rubber,* have been granted during the past year, which claim some notice in this place. The first of these, is for the use of the *hyposulphite of zinc.* This salt is prepared in the following manner: In a solution of caustic lime, potash, or other caustic alkali, boil flowers of sulphur until the liquor be saturated, and into this liquid pass sulphurous acid gas by any of the known means for the purpose of obtaining a hyposulphite of the alkaline base. The liquid is allowed to stand and cool, and the clear liquor is then decanted into a vessel containing a suitable quantity of a saturated solution of the nitrate or other analogous salt of zinc. On mixing these solutions, the zinc is precipitated in a white powder which is regarded as the hyposulphite of zinc. It is then washed on a filter, dried and subsequently ground in a paint mill. Three pounds of this powder is mixed with ten pounds of India rubber, and heated from three to five hours at a temperature of 260°, 280°. The rubber, according to the inventor, will be found completely cured or vulcanized, and requires no free sulphur to be used in any part of the process, and no washing with alkali as do the ordinary materials used for vulcanizing. Hence, it is alleged, that this process is adapted to the covering of silks, and other delicate textures, and coloured fabrics.

Another patent for a *compound for vulcanizing India rubber,* has been granted, in which the mode of treatment is much the same as the last, and produces the same result. The material is the artificial *bi-sulphuret of zinc.* The inventor claims the use of this composition without the use of sulphur in any part of the process of manufacture, and the washing with alkaline solutions is not required, and is not used in this mode of manufacture.

Distilling Crude Turpentine, so as to accomplish two processes in one, namely, distilling the turpentine and boiling soap. This is done by mixing the raw turpentine with the requisite quantity of alkali to saponify the rosin at the same time that the spirits are evaporated and passed into a condenser for use; the rosin is thus saponified and prepared for the business of soap making.

Purifying Gas in the Retort where it is generated.—A patent has been granted for this device which consists in the mixture of coke and lime in the retort for generating coal gas. The inventor alleges that he increases the quantity as well as the quality of the gas, and saves a considerable amount of matter usually deposited in the purifiers and other parts of the condensing apparatus.

Preparing Wheat for Grinding.—The object being to so act on the hull of the grain by a chemical agent, as to render the process of separating it more easy and more perfect. This consists in sprinkling the grain before grinding with a dilute acid, which hardens and stiffens the hull, and thus loosens it, by which process it is readily separated, and, as alleged by the inventor, grain so treated is fitted to make better flour.

Household Furniture.—*Bedsteads and Fastenings.*—A camp bed or chest, so arranged that when the chest or bureau lets down its top and sides, so as to be opened in the widest way, it constitutes a wide bed, that is, when the front and back are let down—but when the ends are let down it forms a narrow or single bed.

Chairs and Tables.—Three patents have been granted. One for a nursery chair, one for a car seat, and one for an extension table.

The first of these claims a passing notice. The principal feature of novelty consists in the removal of the back, and fitting it in front, and drawing out at the same time a slide in the side of the chair, and taking with it one of the arms, which together constitute the end piece and bottom support of the cradle, so that a rocking chair with a high back may be converted into a cradle by the removal and adjustment of the parts herein named.

The point of novelty in the extension table is chiefly confined to the leaf, or leaves, which are constructed of thin plates of metal, having the ends of the leaves bent down, so as to constitute a flange, each individual flange being received into that of its fellow, or *vice versa,* so that when the leaves are closed up to make a compact table, each leaf of the extensible parts is shut in under or over its fellow, and when drawn out, the leaves, edge upon edge, lie over each other like the shingles of a roof, and yet the leaves are so thin that they appear when seen extended, as a plane surface.

A Fly Trap has been patented of the following construction. It consists of a horizontal cylinder, rotating within a box open above. The upper part of the cylinder with its ribs, projects a little above the body of the box, and has its surface smeared with molasses. On one side of the box, and that side towards which the cylinder rotates, a space is cut away and a glass plate let in, in its stead, which glass plate fits pretty closely to the projecting ribs on the cylinder. The cylinder rotates very slowly, by means of clock work. Flies alight on the upper surface of the cylinder and feed on the saccharine matter while the cylinder rolls slowly forward, and brings the fly behind the glass plate before he is aware, and from which there is no escape. He is gradually carried to the under and dark part of the box, where he is brushed off by machinery moved for this purpose.

Machine to wash dishes.—Designed as a substitute for the ordinary hand work. It consists of an oblong, somewhat irregular shaped vessel, generally made of tinned plate metal, and containing on one side a vertical rotating cylindrical frame, to contain the dishes to be washed, and on the other, a horizontal reel formed cylinder, with buckets or dashers on the arms of it, which are designed to dip into the water in the lower part of the vessel, and to dash the same against the dishes in the vertical revolving frame, so that every part of it shall be exposed to the hot water in the machine.

(To be continued.)

SOCIETIES.

ROYAL INSTITUTION.

February 6th.

The Duke of Northumberland, President, in the chair.

J. Scott Russell, Esq., "On Wave-line Ships and Yachts." The subject placed on the list for consideration this evening has been suggested by the assertion which within a year or two has been so often repeated, that our transatlantic brethren are building better ships than ourselves; that, in short,

Brother Jonathan is going ahead while John Bull is comfortably dozing in his arm-chair; and that if he do not awake speedily, and take a sound survey of his true position, he may soon find himself hopelessly astern. Two questions of a practical nature arise out of this alarming assertion :—1st, Whether the Americans are really in any respect superior to the English in nautical matters ?—2nd, Whether in order to equal them we are to be condemned to descend into mere imitators, or whether we have independent ground from which we can start with certainty and originality on a new career of improvement in naval architecture In the outset I beg permission to say, that I am not one of those who shut their ears to the praises of our young and enterprising brethren over the water, or view their rapid advancement with jealousy. I beg to express my perfect belief in the accounts we have heard of their wonderful achievements in rapid river steam navigation. I am satisfied, as a matter of fact, that twenty-one, twenty-two, and twenty-three miles an hour have been performed, not once, but *often*, by their river steam-boats. To that we cannot in this country offer any parallel. The next point in which they had beaten us was, in the construction of the beautiful packet-ships which carried on the passenger trade between Liverpool and America before the era of ocean steamers. These were the finest ships in the world, and they were mainly owned and sailed by Americans. The next point at which we have come into competition with the Americans has been lately in ocean steam navigation. Three years ago they began. They were immeasurably behind us at starting—they are already nearly equal to us. Their Transatlantic steam-packets equal ours in size, power, and speed; in regularity they are still inferior. If they continue to advance at the present rate of improvement, they will very soon outstrip us. Next I come to the trade which has long been peculiarly our own—the China trade. The clipper ships which they have recently sent home to this country have astonished the fine ships of own own Smiths and Greens. Our best shipowners are now trembling for their trade and reputation. Finally, it is true that the Americans have sent over to England a yacht, called the *America*, which has found on this side of the Atlantic no match; and we only escaped the disgrace of her having returned to America without any of ns having had the courage to accept her defiance, through the chivalry of one gentleman, who accepted the challenge with a yacht of half the size, on this principle, so worthy of John Bull, "that the Yankee, although he might say that he had beaten us, should not be able to say that we had all run away." Such, then, at present is our actual position in the matter of ships, yachts, and steam navigation—a position highly creditable to the Americans, and which deserves our own very serious consideration. I propose to examine a little into the physical causes of the naval success of the Americans ; but before doing so, permit me to point out a moral one, which later in the evening you will also find to lie at the bottom of the physical causes. It is this:—John Bull has a prejudice against novelty—Brother Jonathan has a prejudice equally strong in favour of it. We adhere to tradition in trade, manners, customs, professions, humours—Jonathan despises it. I don't say he is right and we are wrong ; but this difference becomes very important when a race of competition is to be run. These preliminary remarks find immediate application in the causes which have led to our loss of character on the sea. The Americans, constantly on the alert, have carried out and applied every new discovery to the advancement of navigation; while with the English, naval construction and seamanship is exactly that branch of practice in which science has not only been disregarded, but is altogether despised and set aside. The American ships show what can be done by modern science unflinchingly put in practice : the English show what can be done in spite of science, and in defiance of its principles. The immediate cause of the defects of English ships, and the most glaring instance of the outrage of all true principle in the practice of navigation, was to be found for many years in the English tonnage law. It was simply an Act of Parliament for the effectual and compulsory construction of bad ships. Under that law, the present fleet of merchant-ships and race of shipbuilders have chiefly grown up ; aud though at length, and only recently abrogated, its influence is still left behind, and is widely prevalent. This Act of Parliament compelled the construction of bad ships nnder heavy penalties. The old tonnage law, according to which ships were built and registered, and taxed, and bought and sold, virtually said to the builder and owner, "Thou shalt not build a ship of the necessary beam to carry sail ; thou shalt not give her the depth and height necessary to security and seaworthiness ; thou shalt not build her of any suitable shape for speed, under penalty of 20, 30, and 40 per cent. of fine for every ton of freight so carried in such ship." In short, the law offered a premium on a ship, the amount of which was in the proportion of her being wall-sided, top-heavy, crank, unweatherly, and slow ; while it iuflicted a penalty in the shape of port-charges and pilot, harbour-dues, lights, &c., in proportion to her fitness and reputation as a sea-worthy, fast, and wholesome ship. To cheat the law—that is, to build a tolerable ship in spite of it,—was the highest achievement left to an English builder, and formed his continual occupation. The manner in which the English system was opposed to the good qualities of a ship, especially speed, is only to be understood by an analysis of those qualitics. The two examples selected for illustration of the qualities of sailing vessels, were the yacht *America*, built without restriction of any kind, and the yacht *Titania*, built under the restrictions of the law of measurement of tonnage, which is still retained in all its deformity by the English yacht squadrou. It was shown how the element of "stand-up-ativeness" is dependent on the beam of the vessel at the water-line; how the power of carrying sail depends on this element ; and how this element is prohibited to the utmost by the Yacht Club's law of tonnage. Another element of the vessel, the area of her vertical longitudinal section immersed in the water, is by another portion of the law compelled to be reduced in an injurious degree. It was next shown that, in the other elements of the form of the two vessels, they were nearly identical ; and that they were *both*, under water, constructed on the *wave principle*, in its most perfect form. But for the existence of these antiquated laws, our yacht-builders and our ship-builders would have had nothing to fear from competition. Happily, the mercantile tonnage law had been altered, and the new law was all that could be desired; and in consequence a new race of fast ships was rapidly springing up. The old yacht law unhappily remained. It appeared from the comparison which was instituted between the construction of American and English vessels, that the Americau shipbuilders have gained over the English chiefly by the ready abandonment of old systems of routine, and the adoption of the true principles of science and the most modern discoveries. They have changed their fashion of steamers and ships to meet new circumstauces as they arose. For river steamers they at once abaudoned all the known sea-going forms, and created an absolutely new form and general arrangement both of ship and machinery. We, on the other hand, subject to the prejudices of a class, invariably attempted to make a river steamer as nearly as possible to resemble a sea-going ship propelled by sails. We were even, for a long time, so much ashamed of our paddle-wheels, that we adopted all sorts of inconvenient forms and inapt artifices to conceal them, as if it were a high achievement to make a steam vessel be mistaken for a sailing vessel. The fine sharp bows which the wave principle has brought to our knowledge, have been adopted in this country with the greatest reluctance; and those who adopt them are often unwilling to allow that they are wave-bows, and would fain assert that "thcy always built them so," were it not that ships' lines are able to speak for themselves. The Americans, however, adopted the wave-bow without reluctance, and avowed it with pleasure the moment they found it give them economy aud speed. In like manner the Americans having found the wave-bow or hollow bow good for steamers, were quite ready to believe that it might be equally good for sailing vessels. We, on the other hand, have kept on asserting that though we could not deny its efficacy for steamers it would never do for vessels that were meant to carry sail. The Americans, on the contrary, immediately tried it on their pilot-boats, and finding it succeed there, avowed at once, in their latest treatise on naval architecture, the complete success of the principle; not even disclaiming its British origin. To prove to ourselves our insensibility to its advantages, they built the *America*, carried out the wave principle to the utmost, and, despising the prejudices and antiquated regulations of onr clubs, came over and beat us. The diagrams and models which were exhibited showed the water-lines of the *America* to coincide precisely with the theoretical wave-line. In one other point the Americans had shown their implicit faith in science and their disregard of prejudice. Theory says, and has always said, "Sails should sit flat as boards." We have said, "They should be cut so as to hang in graceful waves. It has always been so; we have always done it." The Americans believed in principle, and with flat sails went one point nearer to the wind, leaving prejudice aud picturesque sails far to leeward. In

other points the Americans beat us by the use of science. They use all the refinements of science in their rigging and tackle; they, it is true, have to employ better educated and more intelligent men—they *do so*; and by emplo;in a smaller number of hands, beat us in efficiency as well as in economy.

INSTITUTION OF CIVIL ENGINEERS.

March 23rd, 1852.

James M. Rendell, Esq., President, in the Chair.

The first paper read was "On the Results of the use of Tubular Boilers, or of Flue Boilers of Inadequate Surface, or Imperfect Absorption of Heat," by Admiral Earl Dundonald.

This paper advocated the general introduction of what were termed, "economical heat trap hoilers," or boilers having vertical water tubes, instead of oblique fire tubes, contained within a chamber, into the upper of which the hot products of combustion were introduced, and allowed to circulate until, by the abstraction of heat, they descended to the bottom, and passed into the chimney at a temperature little exceeding that of boiling water. From some trials which had been made at Woolwich and Chatham in 1844, as well as from the experience which had been gained by their actual application to some of the North American transatlantic steam packets, and some in the service of the Emperor of Russia, it was contended that these boilers possessed greater evaporative powers, and were more economical than those ordinarily in use; and, moreover, that their safety was much greater, owing to the products of combustion passing into the chimney at a very low temperature, instead of the usual high temperature, from which it was apprehended much danger had been, and might still be, incurred.

The second paper read was, "On certain points in the construction of Marine Boilers," by Mr. J. Scott Russell, E. Inst., C.E.

The author having arrived at certain practical results relative to the construction of marine boilers, put them into practice about ten years back, in designing the boilers for the Royal Mail Steam Packets *Clyde*, *Tay*, *Tweed*, and *Teviot*, and as they had been in constant work ever since, running from 42,000 miles to 48,000 miles per annum, without material repairs, he believed their durability, combined with effective combustion and economy of fuel, had been fully established.

The principles on which these boilers were constructed differed from those generally recognised. In the first place it was considered, that a judicious distribution of the most intensely heated surfaces would be conducive to durability; and for this purpose, instead of returning the flues over the furnaces, the top of the furnaces and the hottest flues were brought to the surface of the water, and the cooler, or return flues, were taken to the bottom of the water. The water was admitted at the bottom, and was gradually warmed as it rose, the greatest heat being imparted at the last moment, by which means the bubbles of steam were prevented from accumulating in contact with intensely heated metal. In the next place, the capacity of the furnaces, or fire boxes, was unusually large, and their height above the incandescent fuel much greater than usual. The evaporating surface in these boilers was also much more than customary, there being no less than three feet of evaporating surface for every foot of furnace bars. The process of blowing off was provided for by arranging, under the flues and furnaces, large water spaces, as reservoirs for the collection and blowing off of brine and other deposit.

The last paper was "A description of a Diaphragm Steam Generator," by M. Boutigny (d'Evreux). The principle upon which this steam generator was based, was that "bodies evaporate only from their surfaces." This being received as an axiom, it must necessarily follow that, in the construction of steam boilers, either the evaporating surface of metal should be extended to its utmost limit, or the water should be so divided, and its evaporating surfaces so multiplied, as to arrive at the same end, of obtaining the greatest amount of steam by the expenditure of the least amount of fuel.

The steam generator was described to consist of a vertical cylinder of wrought iron, 25 inches high, by $12\frac{5}{8}$ inches diameter; the base terminating in a hemispherical end, and the upper part closed by a curved lid, upon which was attached the usual steam and safety valves, feed steam, and other pipes, &c. The interior contained a series of diaphragms of wrought iron, pierced with a number of fine holes, and having alternately convex and concave surfaces. They were suspended by three iron rods, at given distances apart, in such a manner as uot to be in contact with the heated exterior, or shell of the boiler. When any water was admitted through the feed pipe, it fell upon the upper (convex) disc, which had a tendency to spread it to the periphery, the largest quantity falling through the perforations in the shape of globules; the secoud diaphragm being concave, tended to direct the fluid from the circumference to the centre, and so on, until, if any fluid reached the bottom of the cylinder, it mingled with a thin film of water, in a high state of ebullition, that being the hottest part of the boiler. It appeared, however, that in its transit through these diaphragms, the water was so divided, that exposing a very large surface to the caloric, it was transformed into steam with great rapidity, and with great economy of fuel. The boiler described had been worked for a long time at Paris with great success, giving motion to a steam engine of two horses' power. The consumption of coal was stated to be very small, 789 lbs. of water having been converted into steam by 182 lbs. of coal in nine hours, under a pressure of ten atmospheres.

The chemical part of the question was carefully examined, and it was shown, that at that temperature the iron was exactly in the best condition to bear strain.

The practical application on a large scale was submitted to the engineers, the author having only proposed the system for small boilers, and under circumstances of wanting to obtain a motive power in situations of restricted space, and where first cost was a great object.

ON VENTILATION BY THE PARLOUR FIRE.

BY WILLIAM HOSKING, ESQ.,

Professor of Architecture and of Engineering Constructions at King's College, London.*

The term ventilation does not strictly imply what we intend by its use in reference to buildings used as dwelling-houses, or otherwise for the occupation of breathing creatures. To ventilate is defined "to fan with wind;" but one of the main objects for which houses and other enclosed buildings are made, is shelter *from* the wind. Inasmuch, however, as the wind is but air in motion, and we can only live in air, air may not be shut out of our houses, though, for comfort's sake, we refuse to admit it in the active state of wind. But in doing this—in shutting out the wind—we are apt to put ourselves upon a short allowance of air, and to eke out the short allowance by using the same air over and over again.

There is a broad line of distinction, indeed, to be drawn between in-door and out-door ventilation; for, although the principles upon which nature proceeds are the same, the operation is influenced by the circumstances under which the process may be carried on. Whether it be on the hill-side, open to the winds of heaven, or in a close room, from which all draft of air is excluded, the expired breath, as it leaves the nostrils heated by the fire in the lungs, rises, or seeks to rise, above their level, and may not be again inhaled. Out of doors the cooler or less heated air of the lower level presents itself for respiration unaffected by the spent exhaled air; but in a close apartment, the whole body of included air must soon be affected by whatever process any portion of it may have undergone. The process by which nature carries off spent air, purifies, and returns it uncontaminated, is thus checked by the circumstances under which we place ourselves within doors. All our devices for shelter from the weather, and for domestic convenience and comfort, tend to prevent the process provided by nature from taking effect according to the intention in that respect of the Creator. We not only confine ourselves, indeed, and pen up air in low and close rooms, but we introduce fire by which to warm the enclosed air; wanting light within our dwellings when daylight fails, we introduce another sharer in the pent-up air of our rooms, being fire indeed in another form, but generally under such circumstances, that it not only abstracts from the quantity, but injures the quality of what may remain. But fire, whether in the animal system, in the grate, or in the lamp, cannot long endure the imagined limitation of air.

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* From the Edinburgh New Philosophical Journal.

There must he aecess of air—of vital air—hy some channel or other, or the fire will go out.

An open fire in the grate must, however, have a vent for some of its results, or it will he so disagreeable a companion that its presence could not he endured, even as long as tbe most limited quantity of air would last; and the fire will compel the descent of air by the vent commonly supplied under the name of a flue—a chimney flue—to render its presence tolerable in a closed room, if a supply be not otherwise ohtainable. But as the outer air at the higher level of the top of the chimney, hecause of the rarity of the air in and above the flue, responds to the demand of the fire less easily than tbe lower air, or that at and about the level of the fire; and the lower air, or air at tbe lower levels, forces its way in, therefore, by any opening it ean find or make —through the joints of the flooring-hoards, and under tbe skirtings—the supply passing first up or down the hollow lathed and plastered partitions, sometimes even up from tbe drains; and through tbc joints under and ahout the doors and windows. If these channels do not exist, as tbey may not when the joiners' work and the plastering are good, or wben the open joints referred to are stopped up by any means, the fire smokes, and every known means of curing the chimney failing, means are sought of ohtaining heat without the offending fire. Ventilation is not thought of yet.

The open fire may he made to give place to the close stove or to bot-air pipes, to hot-water pipes, or to steam-pipes — which make hot the air about them in a close room without causing drafts. But the warmth obtained in pipes is costly under any circumstances. Air does not take up heat freely, unless it he driven and made to pass freely over the heated surface; and there being little or no consumption of air, and consequently little or no draft, in connection with heated hodies, such as close stoves and hot pipes, the heat from them is not freely diffused, and is not wholesome. There is with all the expense no ventilation.

Stoves and hot pipes are, moreover, exceedingly dangerous inmates in respect of fire. Such things are the most frequent causes, directly or indirectly, of fires in buildings. Placed upon, or laid among or about the timhers and otber wood-work of hollow floors, and hollow partitions, and in houses with wooden stairs, more conflagrations are occasioned by hot pipes and stoves, tban by anything else, and perhaps more than hy all other things together.

Open stoves witb in-draft or air warmed by being drawn quickly (when it is drawn quickly) over heated surfaces, may be made part of a system of safe and wholesome in-door ventilation; but to be perfect there must be also out-draft with *power* to compel the exit of spent or otherwise unwholesome, air. But the arrangements for and connected with such stoves are special and therefore costly, unless the buildings in which they may be employed have been adapted in building to receive tbem. And in-draft stoves may, however, he applied with great advantage as it regards the general warmth and ventilation, in the lowest story of any house, if there he compelled out-draft at the highest level to which it will naturally direct itself if it he not retained, so that the in-drafted air, tempered as it enters, may be drawn out as it becomes spent, or otherwise contaminated.

But this must he considered in all endeavours to affect in-door ventilation, or the endeavour will fail. *The air must be acted upon, and not be left, or be expected to act of itself, and to pass in or out as may be desired, merely because ways of ingress and egress are made for it.* Make a fire in a room, or apply an air-pump to the room, and the outer air will respond to the power exerted hy either hy any course that may be open to it, and supply the place of that which may be consumed or ejected; but open a window in an otherwise close room, and no air will enter; no air can enter, indeed, unless force be applied as with a bellows, whereby as much may be driven out as is driven in, with the effect only of diluting, not of purifying. Even at that short season of the year in which windows may be freely opened, unless windows are so placed as to admit of the processes of out-door ventilation being carried on through them by a thorough draft from low levels to high levels, open windows are not sufficient to effect thorough in-door ventilation. There must for this purpose he in every room a way hy which a draft can be ohtained, and this draft must take effect upon tbe most impure air of the room, which is that of the highest level. The chimney opening may supply a way at a low level, and a draft may he established between it and the window, but the air removed from the room by such a draft is not necessarily the spent or foul air. But make an opening into the chimney flue near the highest level in tbe room, that is to say, as near as may he to the ceiling, and if a draft be estahlished hetween the window and the flue hy this opening, the ventilation is complete; that is to say again, if there he draft enough in the chimney flue from any cause to induce an up-current tbrough it, or if there be motion of the external air to drive the air in at tbe window and force an up-current through the flue.

Windows may not be put open in the long enduring colder season, however, and for tbe same reason in-drafts of the outer air by any other channel are offensive and injurious. To open a door for the sake of air is hut a modification of opening a window, and, if the door he an internal one, with the effect of admitting already enclosed, and, prohahly, contaminated air. Means of efficient in-door ventilation must therefore he independent of windows and doors; and the means should be such as will lead to a result at once wholesome and agreeahle.

Many plans have heen suggested, and some have been carried into effect, of warming air, and then forcing it into or drawing it througb buildings, and, in the process of doing so, removing the foul or spent air from the apartments to which it may he applied. Some of these plans are more and some are less availahle to wholesome and agreeahle in-door ventilation, hut even the best are rather adapted to large apartments, sucb as those of hospitals, churches, theatres, and assembly-rooms, tban to private dwelling-bouses in which the rooms are small and lahour and cost are to he economised.

Plans have been proposed, too, for the economical ventilation of dwelling-houses; but they seem to he all in a greater or less degree imperfect. Ways of access are provided in some cases for the outer air directly to the fire in every apartment, to feed the fire, and indirectly to ventilate the room; way of egress in addition to the chimney opening and the chimney flue being sometimes provided for the spent air of the room; sometimes, indeed, as before indicated, by an opening into tbe cbimney flue near tbc ceiling. A direct in-draft of cold air is not agreeahle, and it may be pernicious ; but if the outer air hecome warm in its way to tbe inmates of the room, the ohjection to its directness ceases. If, however, the warmtb is imparted to it witb foulness, the process does not fulfil tbe condition as to wholesomeness, and this is the case when the outer air is admitted at or near to the ceiling to take up warmth from the spent and heated atmosphere of the bigher levels. Having undergone this process, it is not the fresh air tbat comes warmed to the inmates, but a mixture of fresh and foul air that cannot be agreeable to any inmate conscious of tbe nature of tbe compound.

The endeavour on the present occasion was to show how the familiar fire of an apartment may he made to fulfil all the conditions necessary to ohtain in-door ventilation, to the extent at least of the apartment in which the fire may be maintained, and while it is maintained.

A fire in an ordinary grate establishes a draft in the flue over it with power according to its own intensity, and it acts with tbe same effect, at least, upon the air within its reacb, for the means which enahle it to establish and keep up the draft in the flue. The fire necessarily beats the grate in which it is kept up, and the materials of which grates are composed being necessarily incombustible, and heing also ready recipients and conductors of heat, they will impart beat to whatever may he brought into contact with them.

It is supposed that tbe case containing the body of the grate is set on an iron or stone hearth in the chimney recess, free of the sides and hack except as to the joints in front. Let all communication between the chamber so formed ahout the hack and sides of the grate and the chimney flue be shut off hy an iron plate, open only for the register flap or valve over the fire itself. External air is to he admitted to tbe closed cbamhers tbus obtained about the grate hy a tube or channel leading througb the nearest and most convenient outer wall of the huilding and between tbe joists of the floor of the room, to and under the outer hearth or slab hefore the fire, aud so to and under the hack hearth in which sufficient holes may be made to allow the air entering by the tube or chaunel to rise into the chamber about the fire-box or grate. Openings taking any form that may be agreeable are to he made through the cheeks of tbe grate into the air-chamher at tbe level of the hearth. In this manner will he provided a free inlet for the outer air to the fire-place and to the fire, and of the facility so provided tbe fire will readily avail itself to the abolition of all illicit drafts. But the air in passing through the air-chamber in its way to the fire which draws it, is drawn over

the heated surfaces of the grate, and it thus becomes warmed, and in that condition it reaches the apartment.

An upright metal plate set up behind the openings through cheeks of the grate, but clear of them, will bend the current of warmed air in its passage through the inlet holes, and thus compel the fire to allow what is not necessary to it to pass into the room; and if the opening over the fire to the flue be reduced to the real want of the fire, the consumption of air by the fire will not be so great as may be supposed, and there will remain a supply of tempered air waiting only an inducement to enter for the use of the inmates of the apartment. An opening directly from the room into the flue upon which the fire is acting with a draft more or less strong, at a high level in the room, will afford this inducement; it will allow the draft in the flue to act upon the heated and spent air under the ceiling, and draw it off; and in doing so will induce a flow of the fresh and tempered air from about the body of the grate into the room.

(To be continued.)

GREAT GRIMSBY DOCKS.

We gave some account of the details of construction of these magnificent docks at page 26, vol. 1851, and we are happy to notice that they are likely to be soon thrown open for use. The following account from *Herapath's Journal* brings these notes down to the present time:

It is well known that the authors and the owners of these docks are the Manchester, Sheffield, and Lincolnshire Company. We do not propose to enter now upon the question, whether the docks will remunerate the Company for the outlay; be it remembered that what is done cannot be undone —the £600,000 or £700,000 of capital which the docks have cost is spent; the beneficial work is now to make the best of them. We know the worst feature in them—their great cost. The other side of the account has yet to be made out. Splendid docks are constructed, and admirably situated for the accommodation of traffic. We have to see what return they will make for their outlay. For that, no doubt, a little patience will be required, notwithstanding the energy of the present management, which now includes Messrs. Peto and Geach. Our present task is not, however, to deal, as we have said, with the financial part of the question, but simply to give some description of the new work, and to lay before our readers as many facts concerning it as we have been enabled in a short space of time to collect.

The most striking feature in the new work is what is called the Lighthouse tower, the principal purpose of which, however, is to furnish a column of water for the hydraulic machinery to work the dock gates, &c.—its secondary duty being to display lights for the benefit of the seafaring man. It is a square tower, 105 feet high. The work of it is excellent—we might say beautiful; for the lines are so true, and the taste displayed so good, that it is quite a pleasure to look at it. The tank at the top of this tower holds (for hydraulic pressure purposes) 49,000 gallons of water. The walls of the tower are $4\frac{1}{2}$ feet thick. Though the tower is to a spectator the most noticeable feature in the new structure at Great Grimsby, yet the great work is the formation of the dock with its lock pits, &c.

It might be here observed that Great Grimsby Roads afford the only refuge between the Thames and the Firth of Forth. The old dock was purchased by the Manchester, Sheffield, and Lincolnshire Company, when they decided on their "water terminus." It has an entrance lock of 150 feet in length, and 37 width, with 18 feet on its cill at high tide. In 1845 they obtained an act for the new dock; the first stone was laid by Prince Albert on the 18th April, 1849. The entrance tidal basin has an area of 15 acres, its depth at low spring tides is 9 feet; low neaps, $12\frac{1}{2}$; high springs, $27\frac{1}{2}$: high neaps, $24\frac{1}{2}$; at landing slip, within the tidal-basin, the largest steamers can lay-to safely at any time of tide. The dock is entered from its tidal basin by two locks of massive masonry, with double gates for ebb and flood tides. The larger lock, constructed (by arrangement with Government) to admit the largest war steamers, is in length between gates 200 feet, breadth from wall to wall 70, depth on cill at low springs 7 feet, neaps, $10\frac{1}{2}$, high springs, $25\frac{1}{2}$, high neaps, $22\frac{1}{4}$, at half tide the average depth on cill is 16 to 17 feet, at three quarters tide 20 to 22 feet. The small or second lock is for general purposes, and is in length between gates 200 feet, breadth from wall to wall 45, and its cill being 9 inches below large lock, it will have at half tide a depth of water of 17 to 18 feet, and at three-quarter tide from 21 to 22 feet. The dock has a water area of upwards of 25 acres, including timber pond at the upper end, and it will never contain a less depth of pure fresh water than 25 feet at its entrance, shoaling gradually to 20 feet at the timber pond; the general depth will be 2 feet more. The supply of pure fresh water is important to steamers, as it will secure the full term of durability to their boilers. In case of war a whole fleet of war-steamers could reach the German Ocean in half an hour. In constructing these works 135 acres have been reclaimed; wharfs or quays extend 3,600 feet in length, quays to be traversed by railways from the main lines and into sheds and warehouses. Sheds are close to the quays 750 feet in length, and 50 feet in breadth, affording a covered area of 4,000 feet; and a vaulted warehouse 150 feet square for free and bonded goods. All the machinery and the accessories are on the newest and most perfect principles, and the arrangements for passenger traffic and light or perishable merchandise are on an equally complete scale, the railway extending to the edge of a low water landing-stage in the outer tidal-basin, where a station is built, provided with accommodation for passengers, who, without leaving the cover of the station, may be carried by trains in attendance, as goods also may, to any part of England or Scotland. A large hotel of the first-class has been built by the Earl of Yarborough, the Chairman of the Company. The Manchester, Sheffield, and Lincolnshire Company have constructed extensive works there; the tidal-basin being beyond the limits of the jurisdiction of Hull, ships are free of dock port charges, an advantage which has led to the chartering and discharging of an increased number of timber laden and other vessels, in the new river port of New Holland. For vessels with oil, bones, and other manures, largely consumed in Lincolnshire and Nottinghamshire, the advantages are obvious. For the transit of passengers a pier 1,500 feet in length, to the end of which the trains run, extends into the river, passengers can descend on a covered platform, and passing through two iron tubes to a floating iron pontoon, go on board steam boats fitted after the American fashion, with decked saloons, which lie alongside. The heavy goods traffic is conveyed to Hull principally in lighters, towed by steam-tugs, and by an iron steam screw. New Holland is the railway village of the Manchester, Sheffield, and Lincolnshire Railway, like Crewe on the London and North Western Railway. All the populous and wealthy exporting and importing districts are brought into communication with the ports of the German Ocean and Baltic Sea through the railway terminus at the port of Great Grimsby. Thus it has been brought within five hours of Leicester, Nottingham, and the lace and hosiery districts, six hours of Birmingham and the hardware districts, three hours of Sheffield and the fine steel district, four hours of the pottery district, five hours of Leeds or Huddersfield and the woollen districts, five hours of Manchester and the cotton districts, and seven hours of London. That is to say, nearer to all the manufacturing districts than Manchester was to Liverpool, for the transmission of heavy merchandise or raw material, fifty years ago. In the coasting trade three voyages may be made to Grimsby in the time of two to Hull.

CORRESPONDENCE.

ON THE PREVENTION AND EXTINCTION OF FIRE ON BOARD STEAM-VESSELS.

Illustrated by Plate 5.

To the Editor of the Artizan.

Sir,—At the present moment we think it may interest your readers to discuss those plans which it is desirable should be brought forward for the prevention and extinction of fire on board steamers. The arrangement which we have proposed to apply to a steamer to be built under our inspection is as follows:—*p p* are water-tight bulk-heads constructed double, with a space between, on the cellular principle, by which very great strength may be obtained with but a slight increase of weight. This is material in case of a compartment filling from a leak, as a ship suffers much in a seaway, if an unconfined body of water be washing about in her. These bulkheads are equally applicable to wooden vessels, and would be of important benefit to vessels of war, as in the event of a shot striking between wind and water, they would diminish, if not entirely remove, the risk from leakage.

In case of fire, it is proposed to fill these bulkheads with water, so as to cut off all communication between the different compartments of the vessel.

The arrangements on board all vessels at present for obtaining an ample supply of water are very defective. Two pumps, to discharge 4 tons of water per minute, would not be too large for a first-class steamer. These pumps it is proposed to connect to a range of pipes, say as at *r*, carried fore and aft, with branches commanding every part of the ship. It would be desirable to place these pumps at different parts of the vessel, so that they could not both be rendered inaccessible by a fire suddenly breaking out, and the ends of the branches might be closed with such a material as would readily burst when the pressure was applied; provision being made to close them securely, if the water were required at another point. The great point to be aimed at in all such arrangements we conceive to be, *to leave as little as possible to be done when the emergency occurs.*

The coal bunkers should be ventilated by vertical pipes, *o o*, with branches, *s s*, perforated with holes, in the latter, on the under side only, to prevent their choking. Heating of the coals would thus be almost entirely prevented, and, at any rate, easily detected. The same pipes would serve, in the event of fire taking place, to flood the bunkers by.

Trusting you will excuse the rough form of these hasty notes,

We are, Sir,

Your obedient Servants,

J. & W. DUDGEON.

EXPANSION SLIDE GEAR.

Sir,—I certainly thought Mr. Dudgeon's proposals were to apply "his new form of Expansion Gear," to the D valve at present in use; I could not otherwise see the meaning of his claims, to "connection to any common slide," and at a trifling expense; the whole article besides, is written to illustrate the gear alone, his equilibrium valve gear, (to be described in a future article,) being merely mentioned: these, in connection with his remarks on the economy of Atlantic steam navigation, led me into the error, which I think, is to be attributed as much to his lack of perspicuity, as to my dulness.

If Mr. Dudgeon means, that the *simple power* of one man is sufficient to work his slide, when he says, one only is required to work each engine, then the new gear will work well; and the ease and rapidity of handling, during thick weather, when in the track of sailing vessels, in the vicinity of ice, or drawing in on land, may be added to the list of advantages; to say nothing of the great boon to the men, a whole watch of whom are required to work the murderous long D with rapidity and precision: this command over such a power must however be exercised with judgment; I have heard that a crosstail was broken on board the *Pacific* some time last year, in consequence of the too abrupt check given by the large conical valves, when backing suddenly off Cape Race. If Mr. D. refers again to my letter, he will find I only object to the very rapid *admission* of the steam, but with his guaranteed speed, (*Query?*)—I may be wrong.

I can see no parallel whatever between this German Ocean trip and an Atlantic one, neither as regards ship, nor weather. This wonder in steam navigation consumes, say 30 tons per run, (27 being the quantity at 13 knots, a higher consumption per nominal horse-power than that of the Cunard ships;) her engine arrangements will of course be such as should yield the best possible effect, on an almost unvarying displacement, and proper trim, allowing the engines to work to probably five times their nominal power, and hence the result, which in this country, within the last two or three years, has become quite common. On the other hand, the Cunard steamers leave Liverpool frequently on a draft of 20 feet, and displacement of over 3,500 tons; now, supposing them to consume 830 to 850 tons coals (pretty near truth in winter), they will arrive at New York on a draft of 16 feet, having risen 4 feet during the voyage. Again, as regards the weather, I may just ask Mr. D. what new creation is this ship of his which, in as bad weather to one of her class, enables her to proceed with a reduction of from 32 to 27 revolutions per minute, when he himself instances, (as a thing of no unfrequent occurrence) other, and larger ships having their engines brought up from 18 or 19 to 8 or 9, and then venture to assure him, that he has yet to see the worst German Ocean weather, which will but give him the idea of an Atlantic storm in miniature; had he been on board the *Niagara* on her last voyage out to New York, he would have been greatly enlightened on this subject, he would then have seen the necessity of reducing the power to prevent the ship tearing herself to pieces, and breaking the legs and arms of the crew; as it was, her upper works were much damaged, and one man severely injured; this more or less happens every winter. It has been my misfortune that, for the last 13 years, my business has led me across the Atlantic, often twice each winter, and I flatter myself I care as little for a wet jacket as Mr. D. I am likewise fond of clean decks, but I have no ambition to be made the medium by which the slops are cleared off; to be swept from forward, and be brought up bruised, maimed, if not lifeless, by the first fixed obstacle on deck, is anything but inviting locomotion. As Mr. D. has never heard of the expansion valves being used to save fuel, head to sea and in a gale of wind, I would ask him, what better mode he could adopt when the ostensible object is to ease the ship? I may not understand the operation of banking the fires, but it seems to me best suited *when no steam at all is wanted;* my idea would be, to work with a thin fire and close up the air passages, just admitting sufficient to produce complete combustion; but he may adopt any mode he pleases, I will fall back upon using the expansion valves.

I, for one, see no difficulty in building a ship to average, throughout the year, a speed of 13 knots. I likewise think a saving of 16 per cent. may be made, but at a *considerable increase of pressure*, and yet I am quite at a loss to conceive, by what combinations of mechanical principles Mr. Dudgeon can guarantee a minimum of 20 revolutions per minute to the engines; this, in my opinion, amounts to a guarantee of the weather.

I had read the article Mr. D. refers me to before I wrote to you in September, but it has no bearing on the point at issue; I merely assert that, by the application of his valve-gear *alone* to every vessel now crossing the Atlantic, he cannot save 1-6th of the fuel; he seems to be unaware that these ships have the means, and employ them, of carrying out the expansive principle to considerable extent. If Mr. D. will be at the trouble of making up a table, showing the saving by expansion with the secondary valve, he will find, or I am much mistaken, his 16 per cent. diminished to 4 or 5, as I before asserted.

I will not trespass further, Mr. Editor, on your valuable paper than to assure you, that however obliged I shall feel by Mr. Dudgeon's future explanations, you will hear no more from me on this subject.

AN OLD SALT ENGINEER.

Boston, United States,
February 17th, 1852.

PROGRESS OF STEAM NAVIGATION.

The *Madras* iron screw steamer, built by Messrs. Tod & McGregor for the Peninsular and Oriental Company, has arrived at Southampton after a run of 61 hours, including stoppages. She is of the following dimensions:—

	Feet.	ins.
Length between stem and stern-post	232	0
Breadth amidships	31	6
Depth of hold	21	2

Burden, builders' measurement, between 1,300 and 1,400 tons. Engines, of 260-horse power. She is calculated to carry 600 tons measurement goods, and 300 tons of coals, has two decks, and is full barque-rigged, with an immense spread of canvas. When the *Madras* left Glasgow, she had on board 290 tons of coals, and about 150 tons weight of iron; her speed varied from 8 to 12 knots. Messrs. Tod and McGregor are also building a sister vessel, the *Bombay*, and also the *Calcutta*, a screw of 2,500 tons, for the Company.

The immense amount of marine work now on the Clyde fully corroborates our opinion previously expressed, that London will in time be beaten out of the field in heavy engineering work, which can be executed more economically in localities where rent, wages, and materials are much lower.

Rule for calculating the weight that can be safely trusted upon a pile which is driven for the foundation of a heavy structure. By John Sanders, Brev. Maj. U. S. Eng.

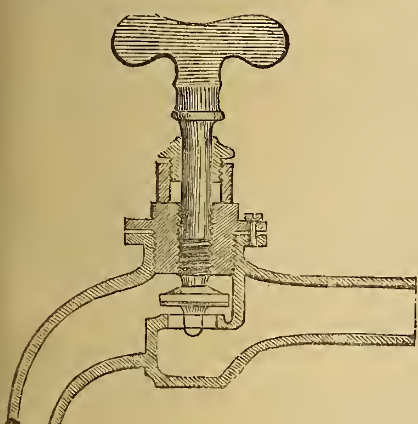
A simple empirical rule, derived from an extensive series of experiments in pile driving, made in establishing the foundation for fort Delaware, will doubtless prove acceptable to such constructors and builders as may have to resort to the use of piles, without having an opportunity of making similar researches. I believe that full confidence may be placed in the correctness of this rule, but I am not at present prepared to offer a statement of the facts and theory upon which it is founded.

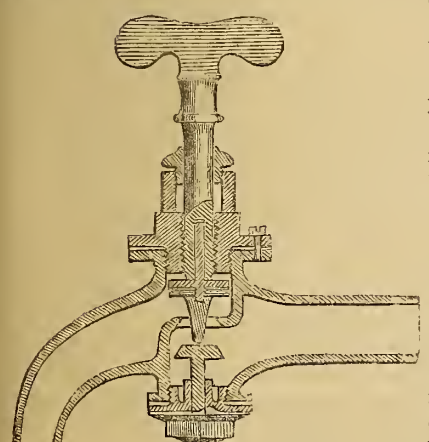
Suppose a pile to be driven until it meets such a uniform resistance as is

indicated by slight and nearly equal penetrations, for several successive blows of the ram, and that this is done with a heavy ram (its weight at least exceeding that of the pile), made to fall from such a height that the force of its blow will not be spent in merely overcoming the inertion of the pile, but at the same time not from so great a height as to generate a force which would expend itself in crushing the fibres of the head of the pile. In such a case it will be found that the pile will safely bear, without danger of further subsidence, "*as many times the weight of the ram, as the distance which the pile is sunk the last blow, is contained in the distance which the ram falls in making that blow, divided by eight.*" For example, let us take a practical case, in which the ram weighs one ton, and falls six feet, and in which the pile is sunk half an inch by the last blow; then, as half an inch is contained 144 times in 72 inches, the height the ram falls, if we divide 144 by 8, the quotient obtained, 18, gives the number of tons which may be built with perfect safety, in the form of a wall, upon such a pile.

NOVELTIES.

Chrime's Patent High Pressure Cocks. These Cocks, as made by Messrs. Guest and Chrimes, of Rotherham, are now in extensive use; an experience of some four or five years having settled the point in their favour. The valve portion consists, as will be seen by the engravings, of a brass disc, covered with leather, and pressed on to the seat by a screwed spindle, working through a stuffing box. They are, in fact, an engineer's stop-valve in miniature. For high pressures they are more particularly made with the valve loose from the spindle, the valve being lifted by the pressure only.





The advantages which they possess are—perfect security against leakage; facility of repair, by putting on a new leather, without disconnecting the cock; the prevention of concussion, and consequent bursting of the pipes, from shutting off the water too suddenly, and the form of the water way, which gives a larger area than the ordinary plug cock. Mr. Leather, engineer to the Leeds and Bradford water works, gives a very favourable report of their use at those places. We ought to mention that a valve of the same description, but without the leather, was handed to us by Mr. Shanks, engineer, as an American invention, which it may probably be, without detriment to the originality of Mr. Chrime's invention.

North London School of Drawing and Modelling.—We paid a visit a few evenings since to this school, which has been established in High-street, Camden Town, to afford a sound course of instruction to both sexes, in drawing and modelling. We were informed that there are at present 160 pupils on the books, the number being only limited by the extent of the accommodation available. Of these, about 30 are females. The terms of admission for three lessons a week in both, art drawing and geometrical drawing, are only 2*s.* per month, and for youths under fifteen years of age, only 1*s.* 6*d.* There are scarcely any occupations, however mechanical, in which the education here acquired would not increase the value of the student to his employer, whilst there can be no doubt of its elevating character on the mind. Some of our readers may have it in their power to add to its usefulness by contributing books, engravings, or models, which, they may take our word for it, will not be thrown away. We hope soon to hear of a similar school being established at the east end of London, where there is ample room for it.

Jarrett's Improved Copying and Embossing Presses.—These presses are so convenient that we do not wonder at their coming into such general use. Mr. Jarrett has submitted to us specimens of two new varieties which he has lately brought out. Fig. 1 is a press designed to answer the double purpose of a copying and embossing press, and thereby save room in the office, and first cost. As shown in the sketch, the embossing die is placed above the copying press, the same screw answering for both. It is so arranged that none of the parts require changing to make it serve for either purpose. Fig. 2 is a double lever-press, contrived so that the motion of the handle in either direction gives the impression. This is a convenience when fixed on a double desk. A slit is made in the sides of the press, so that the letter paper when slid in, is certain of being truly placed. A frame is also provided, by which the same thing is effected for envelopes. Motion is given to the die by a cam on the handle. Altogether these presses are the most mechanical things of the kind we have ever seen.

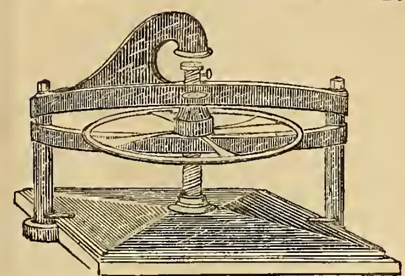


Fig. 1.

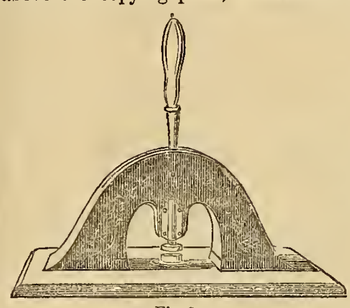


Fig 2.

LIST OF ENGLISH PATENTS.

From 23rd February, to 18th March, 1852.

Six months allowed for enrolment, unless otherwise expressed.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the manufacture of coke, and in application of the gaseous products arising therefrom to useful purposes. (Being a communication.) February 23.

William Stirling Lacon, of Great Yarmouth, Norfolk, gentleman, for improvements in the means of suspending ships' boats, and of lowering the same into the water. February 23.

Samuel Banes, of Bethnal-green, Middlesex, master mariner, for certain improvements in apparatus to be applied to or connected with the cables of ships or other vessels when riding at anchor. February 23.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in machinery for combing and preparing wool and other fibrous substances. (Being a communication.) February 23.

Jean Theodore Coupier and Marie Amedée Charles Mellier, of Maidstone, Kent, gentlemen, for certain improvements in the manufacture of paper. February 23.

Thomas Young Hall, of Newcastle-upon-Tyne, coal owner and colliery viewer, for improvements in screens for screening coal and other substances requiring to be screened. February 23.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street London, patent-agent, for improvements in windmills. (Being a communication.) Feb. 23.

William Walker, of Plymouth, Devon, Commander in the Royal Navy, for a method or means of ascertaining and indicating the deviations or errors of the mariners' compass, February 23.

James Pilling, of Rochdale, Lancaster, spinner and manufacturer, for certain improvements in looms for weaving. February 23.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in gas-burners. (Being a communication.) February 23.

Alfred Charles Hobbs, of New York, America, engineer, for certain improvements in the construction of locks and other fastenings. February 23.

Thomas Walker, of Birmingham, for improvements in steam engines. February 23.

Samuel Boulton, of Manchester, agent, for improvements in the treatment of metallic ores, and certain salts and residuary matters, and in obtaining products therefrom. February 23.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, for improvements in expressing saccharine fluids, and in the manufacture, refining, and treating sugar. February 24.

Russell Sturgis, of Bishopsgate-street, London, merchant, for improvements in weaving looms. (Being a communication.) February 25.

John Elce, of Manchester, Lancaster, machinist, and John Bond, of Burnley, in the said county, machinist, for certain improvements in machinery for preparing cotton and other fibrous substances; also in machinery or apparatus applicable to looms for weaving, and the tools employed therein. February 26.

Charles Reeves, jun., of Birmingham, Warwick, manufacturer, for certain improvements in the manufacture of bayonets, swords, and other cutting instruments. February 27.

Charles John Mare, of Blackwall, Middlesex, for improvements in constructing iron ships or vessels, and steam boilers. February 27.

James Pilbrow, of Tottenham, Middlesex, civil engineer, for certain improvements in apparatus for supplying the inhabitants of towns and other places with water. March 3.

George Leopold Ludwig Kufahl, of Christopher-street, Finsbury, London, engineer, for improvements in fire-arms. March 3.

George Wilkinson, of Streatham-terrace, Shadwell, engineer, for improvements in ships and other vessels. March 4.

Alfred Trueman, of Swansea, manager of copper smelting works, and John Cameron, of Lougbor, chemist, for improvements in obtaining copper from ores. March 4.

Alexander Parkes, of Birmingham, for improvements in separating silver from other metals. March 8.

Edward Moseley Perkins, of Mark-lane, London, for improvements in the manufacture of cast metal pipes, retorts, or other hollow castings. March 8.

James Graham, of Camden-grove, Peckham, Surrey, for improvements in treating ores containing zinc and the products obtained therefrom. March 8.

James Wanbrough, of Albert-road, Mile-end, manufacturer, and William Allen Turner, of Fish-street-hill, London, merchant, for improvements in the manufacture of flocked fabrics. March 8.

Frederick George Underhay, of Well's-street, Gray's Inn-road, engineer, for improvements in apparatus for regulating the supply of water to water-closets and other vessels, and in taps or cocks for drawing off liquids. March 8.

Enrico Angelo Ludovico Negretti and Joseph Warren Zambra, both of Hatton-garden, London, meteorological instrument makers, for improvements in thermometers, barometers, gauges, and other instruments for ascertaining and registering the temperature, pressure, density, and specific gravity of aeriform fluids and liquids, or solid bodies. March 8.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for combing wool and other fibrous substances. (Being a communication.) March 8.

George Wright, of Sheffield, and also of Rotherham, York, artist, for improvements in stoves, grates, or fire-places. March 8.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in propelling vessels. (Being a communication.) March 8.

Joshua Crockford, of Southampton-place, Middlesex, gentleman, for improvements in brewing, and in brewing apparatus. March 8.

Augustus Turk Forder, of Leamington Priors, Warwick, solicitor, for an improved fender. March 8.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, London, patent agents, for improvements in presses and in pressing. (Being a communication.) March 8.

Charles Augustus Preller, of Abchurch-lane, London, merchant, for improvements in the preparation and preservation of skins, and animal and vegetable substances. (Being a communication.) March 8.

Uriah Scott, of Grove-street, Camden-town, Middlesex, engineer, for improvements in wheels and in springs, and spring-bearings for carriages. March 8.

John Henry Johnson, of Lincoln's-inn Fields, Middlesex, and of Glasgow, for improvements in weaving carpets and other fabrics, and in the machinery or apparatus employed therein. (Being a communication.) March 8.

Walter Young, of Springfield Ironworks, Salford, Lancaster, millwright and engineer, for an improvement or improvements in steam engines. March 8.

Alexander Cuningham, of Glasgow, Lanark, North Britain, ironmaster, for improvements in the treatment and application of slag, or the refuse matter of blast furnaces. March 8.

William Pidding, of the Strand, Middlesex, gentleman, for improvements in mining operations, and in the machinery or apparatus connected therewith. March 8.

Peter Van Kempen, of West Ham, Essex, accountant, for an improved refrigerator to be used in brewing, distilling, and other similar useful purposes. (Being a communication.) March 8.

William Willcocks Sleigh, physician and surgeon, of London, for a counteracting reaction motive-power engine. March 8.

Alexandre Hediard, of Rue Taitbout, Paris, gentleman, for certain improvements in rotary steam engines. March 8.

Paul Rapsey Hodge, civil and mechanical engineer, of Adam-street, Adelphi, Middlesex, for certain improvements in the construction of railways and railway carriages, parts of which are applicable to carriages on common roads. (Being a communication.) March 8.

Thomas Ellison, of Queen's-road, Pentonville, Middlesex, painter, plumber, and glazier, for certain improvements in the manufacture of imitation marbles, granites, and all sorts of stones. March 8.

Pierre Henri Bareau, of Paris, manufacturer, for certain improvements in the manufacture of carpets, velvets, and other fabrics. March 8.

William Smith, of Park-street, Grosvenor-square, civil engineer, and Archibald Smith, of Princes-street, Leicester-square, engineer and machinist, for certain improvements in electric and electro-magnetic telegraph apparatus, and in the machinery for and method of making and laying down submarine, submerged, and other such lines. March 8.

Colin Mather, of Salford, Lancaster, machine-maker, and Ernest Rolffs, of Cologne, Prussia, gentleman, for certain improvements in printing, damping, stiffening, opening, and spreading woven fabrics. March 11.

Benjamin Goodfellow, of Hyde, Chester, engineer, for improvements in boilers for generating steam. March 11.

Joseph Denton, of Rochdale, Lancaster, gentleman, for improvements in machinery or apparatus for manufacturing looped, terry, or other similar fabrics. March 12. (N.B. This patent being opposed at the Great Seal, was not sealed till the 12th March, but bears date the 23rd February last, the day it would have been sealed had no opposition been entered.)

John Mercer, of Oakenshaw, Clayton-le-Moors, chemist, and John Greenwood, of Irwell Springs, Bacup, Turkey-red dyer, both in Lancaster, for certain improvements in preparing cotton and other fabrics for dyeing and printing. March 15.

Francis Wheatley, of Greenwich, Kent, gentleman, for an improved safety cab-omnibus. March 18.

LIST OF SCOTCH PATENTS.

From 22nd of January, to the 22nd of February, 1852.

Aime Nicholas Derode, of Rue St. Roch, Paris, France, gentleman, for a certain process of uniting cast iron to cast iron, and to other metals, and for uniting other metals together. January 26; four months.

George Torr, of the chemical works, Turnley's-lane, Rotherhithe, animal charcoal burner, for improvements in burning animal charcoal. January 26.

James Pillans Wilson, and George Fergusson Wilson, of Wandsworth, Surrey, gentlemen, for improvements in the preparation of wool for the manufacture of woollen and other fabrics, and in the process of obtaining materials to be used for that purpose. January 26.

Victor Lemoing, of Cette, Department of l'Herault, France, for certain improvements in rotary engines. January 26.

John Stopporton, of the Isle of Man, engineer, for certain improvements in propelling vessels, parts of which improvements are applicable to steam engines and pumps. Jan. 28.

Joseph Stenson, of Northampton, engineer and iron manufacturer, for improvements in the manufacture of iron, and in the steam apparatus used therein, part or parts of which are also applicable to evaporative and motive purposes. January 30.

John Chatterton, of Birmingham, Warwick, agent, for certain improvements in protecting insulated electro-telegraphic wires, and in the methods and machinery used for that purpose. January 30.

Sidney Smith, of Nottingham, for improvements in indicating the height of water in steam boilers. February 4.

Francis Clark Monatis, of Earlston, Berwick, builder, for improved hydraulic syphon. February 4.

George Duncan, of the New North-road Hoxton, and Arthur Hutton, of the same place, for improvements in the manufacture of casks. February 6.

George Collier, of Halifax, York, mechanic, for improvements in the manufacture of carpets and other fabrics. February 10.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of pigment or paint. February 11.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for weaving coach-lace, Brussels tapestry, and velvet carpeting, and other pile fabrics. February 13.

James Anderson Young, of Buchanan-street, Glasgow, North Britain, surgeon dentist, for certain improvements in dental operation, and in apparatus or instruments to be used therein. February 16.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in machinery for combing and preparing wool and other fibrous substances. February 13.

Hermann Turck, of Broad-street-buildings, in the City of London, merchant, for improvements in the manufacture of resin oil. February 18.

James Roberton, of Oxford-street, Manchester, chemist, for improved methods of producing or obtaining printing dyes and other substances, which improvements, in whole or in part, are applicable to other like useful purposes. February 20.

LIST OF IRISH PATENTS.

From 21st of January to the 19th of February, 1852.

Edwin Rose, of Manchester, Lancaster, Esq., for certain improvements in boilers for generating steam. February 6.

Frederick Rosenborg, of the Albany, Middlesex, Esq., for improvements in the manufacture of casks, barrels, and other like articles, and the machinery employed therein. February 13.

John Livesey, of New Lenton, Nottingham, draughtsman, for improvements in the manufacture of textile fabrics, and in machinery for producing the same. February 10.

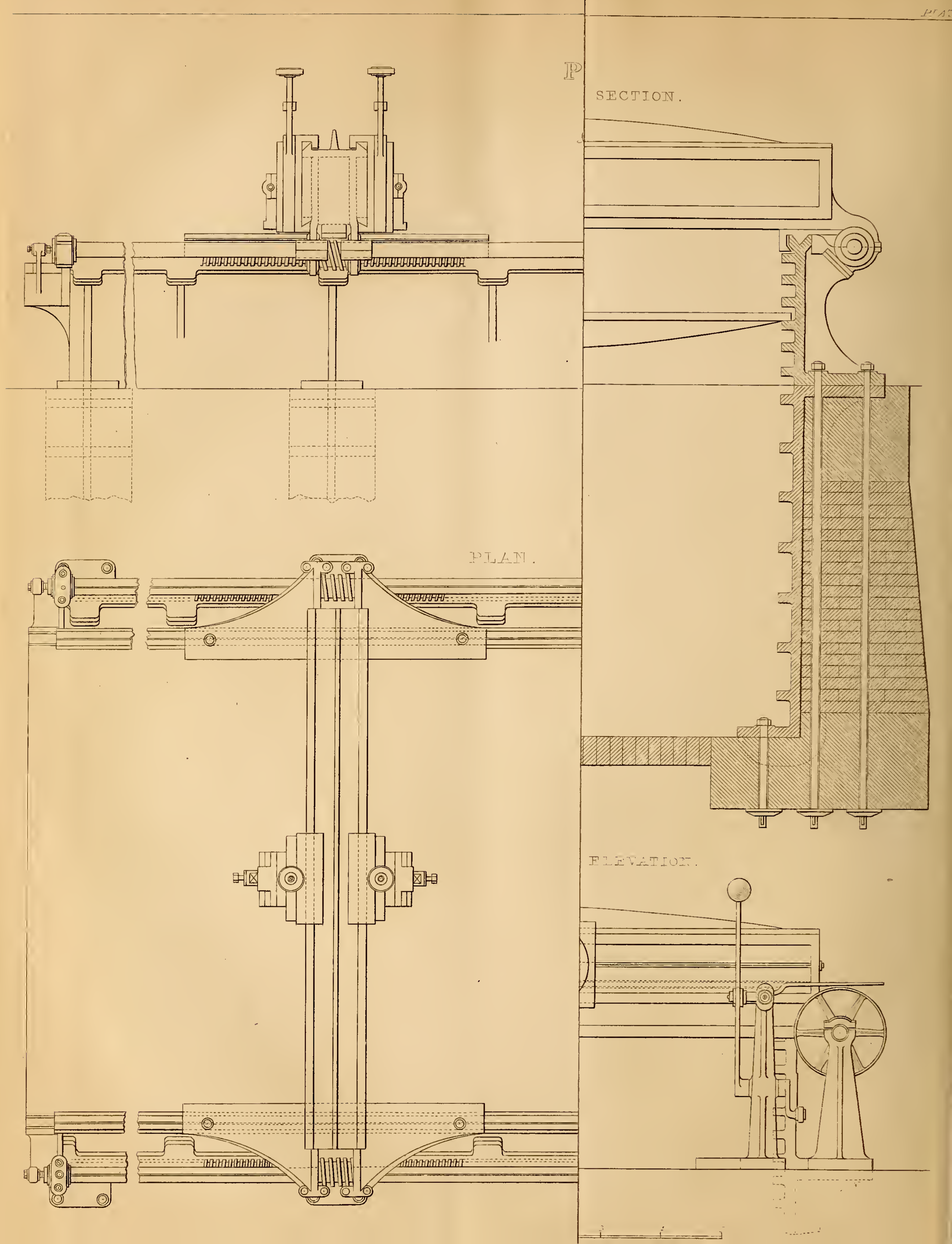
Alexandre Hediard, of Rue Taitbout, Paris, gentleman, for improvements in propelling and navigating ships, boats, and vessels, by steam and other motive power. February 10.

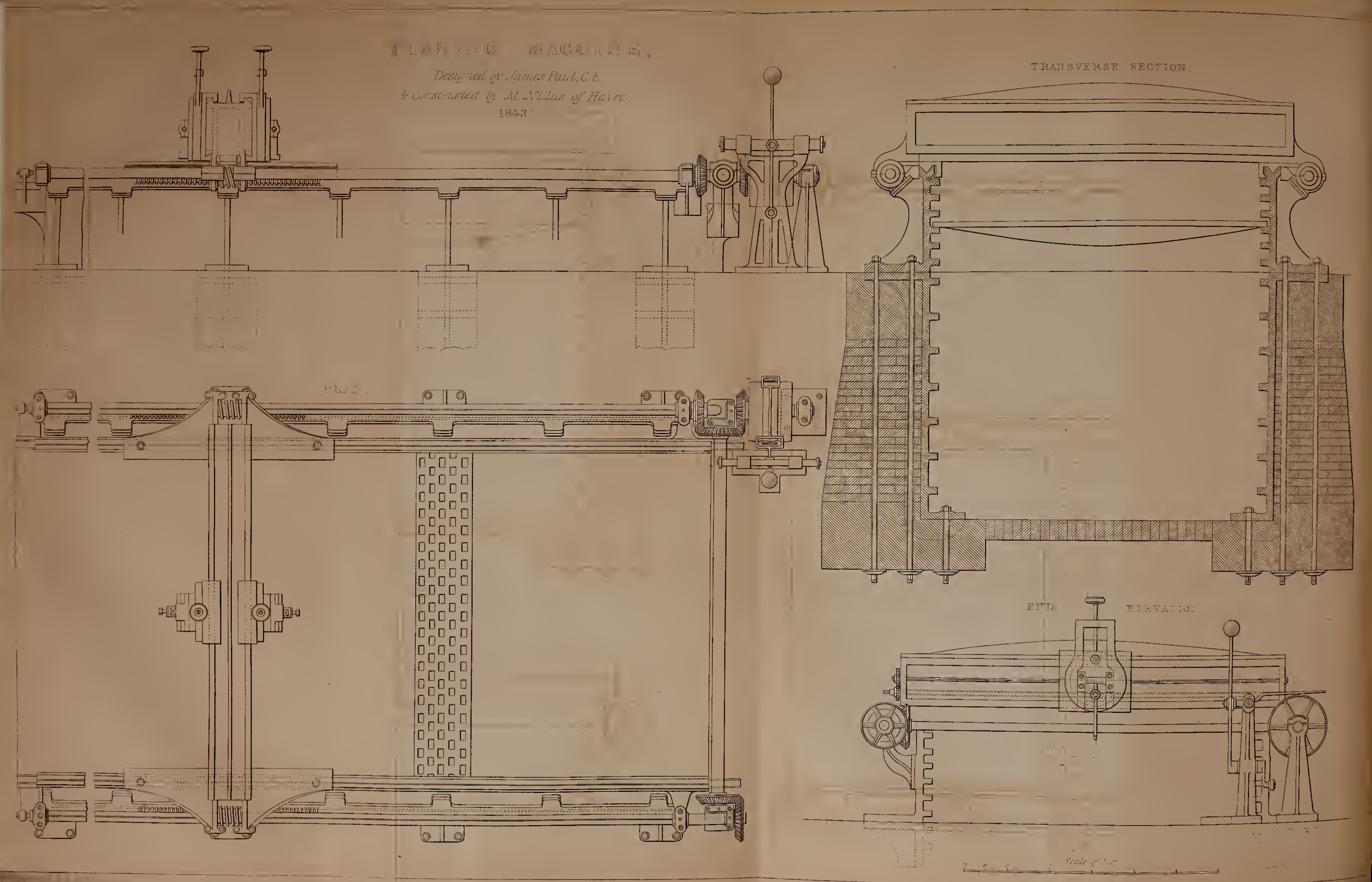
Charles James Pownall, of Addison-road, Middlesex, gentleman, for improvements in the preparation and treatment of flax and other like fibrous vegetable substances. February 11.

DESIGNS FOR ARTICLES OF UTILITY.

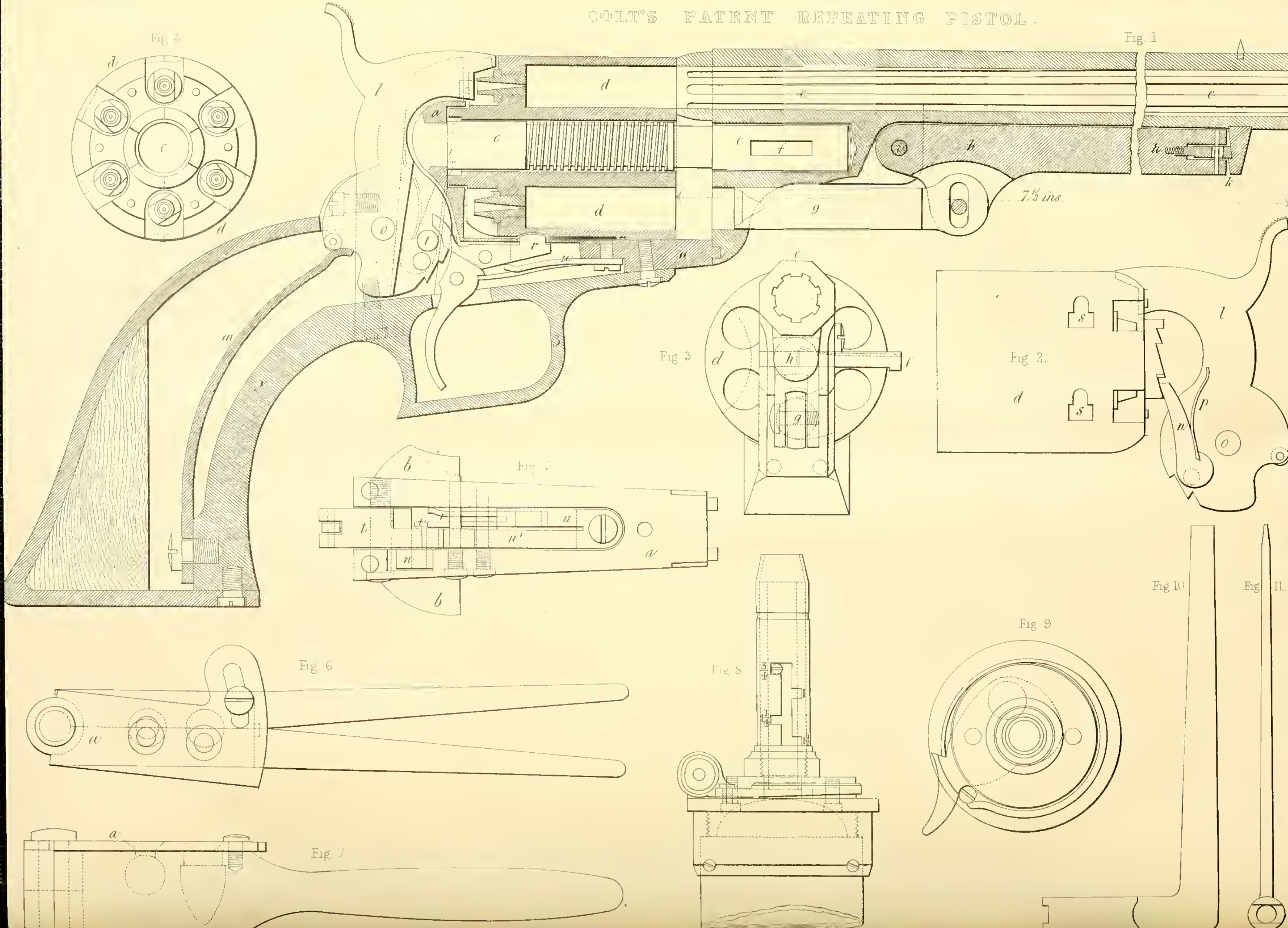
From the 20th February, to the 16th March, 1852, inclusive.

February 20, 3129, J. Keable, Lambourn, "Guard frame for pig trough."
" 20, 3130, J. Jones and Co., Sheffield, "Galoshes for sheep and other cloven-footed animals."
" 21, 3131, G. Murrell, Chelsea, "Anti-mephitical ventilator, or vapour dispeller."
" 21, 3132, J. H. Noone, and W. Exall, Camden Town, "Spring-carriage head."
" 23, 3133, Brown and Redpath, Commercial-road, "Apparatus for lowering boats from ships or other vessels."
" 23, 3134, J. Smith, Coven, near Wolverhampton, "Boiler."
" 24, 3135, J. Purdey, 314½, Oxford-street, "Self-expanding bullet."
" 24, 3136, J. H. Cutler, Birmingham, "Pearl buttons."
" 24, 3137, W. Woolford, Bradford, York, "Seating of singe plates for singeing fabrics."
" 25, 3138, Brown, Marshall and Co., Birmingham, "Railway carriage."
" 25, 3139, R. Best, Birmingham, "Reflector."
" 25, 3140, W. I roger, Newport, Monmouth, "Safety and signal lantern."
" 26, 3141, R. W. Winfield, Birmingham, "Curtain ring-hook."
" 26, 3142, W. Soutter, Birmingham, "Joint for copper and brass kettles and other vessels."
" 26, 3143, C. N. May, Reading, "Smoke preventer."
" 26, 3144, J. Derrington and Co., Manchester, "Tap or cock."
" 26, 3145, C. W. Lancaster, New Bond-street, "Rifle ball."
" 26, 3146, C. W. Lancaster, New Bond-street, "Rifle ball."
" 26, 3147, C. W. Lancaster, New Bond-street, "Rifle ball."
" 26, 3148, T. and S. Knight, Southwark, "Improved boiler."
" 27, 3149, Myers and Son, Birmingham, "Universal India-rubber holder."
" 28, 3150, W. Dodsworth, Bradford, "Spool motion."
" 28, 3151, A. Gatti and E. Prinet, Clerkenwell, "Self-acting card-case."
" 28, 3152, J. Parkinson, Bury, Lancaster, "Cock."
" 28, 3153, H. G. Fuller, Greenwich, "Apparatus for making sail thimbles."
March 1, 3154, T. Sullivan, Foot's-cray, Kent, "Amphaton dandy roller."
" 1, 3155, E. Evans, Brixton, "Screw gas tongs, or wrench."
" 1, 3156, H. Beckwith, Skinner-street, Snow-hill, "Mould for hollow conical bullets."
" 1, 3157, Parsons and Terrill, Caledonian-road, "Cooking apparatus."
" 3, 3158, The Grangemouth Coal Company, Grangemouth, "Heating apparatus for hot-houses and green-houses, &c."
" 3, 3159, B. M. Wilkins, Sutton Coldfield, "Running rein-bridle."
" 4, 3160, J. C. Stokes, Birmingham, "Tap."
" 5, 3161, G. Fletcher and Co., Wolverhampton, "Metallic lath for beds, sofas, couches, &c."
" 5, 3162, H. Swift, Ipswich, "Gutter or water-channel for footpaths and ways."
" 5, 3163, P. Pearson, Manchester, "Machine for folding paper bags."
" 5, 3164, W. Austin, Farnham, "Set of bricks for building walls," &c.
" 6, 3165, H. Kenyon, Liverpool, "Fluted mill-tooth."
" 6, 3166, J. Kealy, Oxford-street, "Knife for turnip-cutters," &c.
" 8, 3167, H. Jones, Birmingham, "Measuring tap."
" 8, 3168, J. Finlay, Glasgow, "Induction Ventilator."
" 9, 3169, G. Benda, 79, Basinghall-street, "Fastening for Porte Monnaies, and other articles."
" 11, 3170, J. Cooper and J. C. Forsell, Leicester, "The crystal reel."
" 11, 3171, D. Simpson, Lancaster, "Regulating pressure-tap."
" 12, 3172, H. Stephens, Stamford-street, Blackfriars, "Adjustable pencil-point."
" 12, 3173, Mr. Bailey, Bayswater, "Safety letter-box."
" 12, 3174, H. Doulton and Co., Lambeth Pottery, "Invert block for the bottoms of sewers or culverts in stoneware."
" 12, 3175, C. and J. Seagrief, Green-street, Park-lane, "Portable wardrobe."
" 13, 3176, A. Marion and Co., Regent-street, "Pencil cutter" (179 Provisional.)
" 13, 3177, C. Gray and Sons, Sheffield, "Reaping machine-knife."
" 15, 3178, Well and Greenway, Birmingham, "Fastening for doors, windows, &c."
" 16, 3179, W. Fife, Birmingham, "Metallic pen."
" 16, 3180, J. Morris and Sons, Astwood Bank, near Redditch, "Needle-case."
" 16, 3181, C. Rowley, Birmingham, "Fastening for elastic bands."
" 16, 3182, W. Stahl and E. Prinet, Yardley-street, Wilmington-square, "New dividers and callipers" (110 Provisional.)
" 16, 3183, J. C. Boyd, Lower Thames-street, "Double action or self-adjusting scythe."


SECTION.
PLAN.
ELEVATION.


PLANING MACHINE,
Designed by James Paul, C.E.
& Constructed by M. Nillus of Havre.
1843.
TRANSVERSE SECTION.
END ELEVATION

COLT'S PATENT REPEATING PISTOL.



THE ARTIZAN.

No. V.—Vol. X.—MAY 1st, 1852.

COLT'S PATENT REPEATING PISTOLS.

Amongst the other specimens of American ingenuity and workmanship which created so much interest at the Great Exhibition, the fire-arms of Colonel Colt were pre-eminent. They afford another instance of the difficulty of overcoming the prejudices which the routine of trade invariably creates. When locomotives were first made, it was at once assumed that the wheels would slip round, and the train would stand still; and, as everybody said so, everybody believed it, and nobody thought of trying the simple experiment. Iu the same manner, although repeating pistols have beeu known for some centuries, nobody had the courage to grapple with the mechanical difficulties, which they took for granted were insurmountable. Colonel Colt, without being aware of the numerous ancient schemes which decorated our museums, but being strongly impressed with the value which such an arm would possess if successful, set himself to work to invent aud construct. After numerous trials, the result was the repeating pistol of which we have given a plate, *full size*. As our readers well know, we aim at practical utility, and we have, therefore, taken some trouble to give them accurate details, which may serve as a guide to the practical man.

We have remarked on the prejudice existing against this innovation. "They would never keep in order," was the "short, sharp, and decisive" way of settling the question, with the anti-progressionists. The Board of Ordnauce, United States, to test this point, had a holster pistol fired *twelve hundred times*, and a belt pistol *fifteen hundred times*, cleaning but once a day, when the Board determined that no further trial was necessary, in which opinion most of our readers will, we doubt not, coincide. They reported, "that ueither of the pistols appeared to be injured by the operation." The penetration of the holster pistol was found to be through 7 inches of board, and the belt pistol through 6 inches, whilst the highest penetration of the common dragoon pistol was only through 5 inches. As regards the "proof" to which fire-arms are subjected, in 1850, 2,082 were "proved" by the ordnance, and only one barrel and one cylinder burst—a smaller proportion than with any other description of arm. So satisfactory was this trial deemed, that the Secretary of War at once assumed the responsibility of contracting with Colonel Colt for 4,000 pistols, without waiting for the official sanction of Congress.

With regard to the price at which these arms can be manufactured, we are informed that Colonel Colt has carried out the use of self-acting tools to such an extent, that 20 per cent. only of the cost is for hand labour, 10 per cent. of which, is for the wages of women and children attending the machines. A perfect uniformity of detail is the result, so that the several parts are put together from a quantity kept on stock, and when on service, those injured in action can be combined with others, so as to make up 70 to 80 per cent. of serviceable arms.

A necessary quality, but one never attained with the ordinary musket, is the power of resisting the effect of immersion in water. The power required to force the ball home, hermetically seals the receptacle for powder, and with the cap on the nipple, the pistol may be immersed in water for several hours without damping the powder.

Fig. 1 is a side elevation in section, the barrel being broken off. Fig. 2 is an elevation of the hammer and chamber detached. Fig. 3 is an end view of the mouth of the barrel, and those of the chamber. Fig. 4 is an end view of the chamber, showing the nipples, and fig. 5 is an *inverted* plan of the trigger, the spring which actuates it, and the hammer, the brass finger guard, *y z*, being supposed to be removed. We will first describe the method in which the various parts are secured together. The piece of metal *a a*, may be said to form the basis of the stock. At the back of it is a boss, *b b*, shown in fig. 5, and shown dotted in fig. 1, which is cored out to receive the hammer, trigger, &c., and serves to cover the nipples. To give room, however, to put the percussion caps on the nipples, the boss is cut away ou one side, as shown in fig. 5 (dotted) for that purpose. In this boss is fixed a pin, *c*, on which the chamber, *d*, revolves; a shallow thread, cut in the piu at this part, serves to hold the oil, which is essential, to enable the chamber to revolve freely. This pin also serves to carry the barrel, which is keyed to it, by means of the key, *f f*. By driving up this key, the barrel is forced into coutact with the chamber, *d*, and the chamber, *d*, in contact with the boss, *a*. To prevent the key being lost, by being completely disconnected from the barrel, a small screw is fixed in the latter, the head of which enters a groove in the key, and prevents it being withdrawn. On the front of the piece, *a a*, are two small pins, which serve to steady the barrel, the projection at the end of which has holes bored to receive them.

The ramrod, *g*, is guided by sliding through the projection forged on the barrel, and is actuated by the lever, *h*, which works on the pin, *i*, as a fulcrum. When not in use, this lever is held in positiou by means of the spring catch, *k*, which is furnished with a spiral spring, so that after being used, the lever is fixed by the mere act of grasping it with the barrel, and it can be instantaneously dis-engaged by pressing down the projecting tongue, which extends transversely beyoud the diameter of the lever, to enable this to be done with facility.

The hammer, *l*, moves on the pin, *o*, as a fulcrum, and is actuated by the spring, *m*, the end of which bears on a friction roller in the heel of the hammer.

From this it will be seen that whenever the barrel and chamber have become foul from use, they can be readily taken to pieces and cleaned. The key, *f*, only requires to be driven back, and the barrel and chamber can then be slipped off the pin, *c*, cleaned, and put together again in a few minutes.

We must now see how the movements of the chamber and hammer are provided for.

The chamber being constructed to carry six charges of powder and ball, must be moved one-sixth of a revolution each time; it must be

held rigidly in a line with the barrel at the moment of firing, and it must be capable of making a complete revolution in order to load it. Fig. 2 shows how the motion of the chamber is provided for. The back end of it is cut into a circular ratchet of six teeth. The lever, *n*, attached by a pin to the hammer, moves the ratchet, as the hammer is raised in the act of cocking, and the lever being held against the ratchet, by means of the spring, *p*, the chamber can be revolved in one direction only. The chamber is held whilst the hammer is falling, by the lever, *r*, the end of which has a tooth on it, which takes into one of the notches, *s*, *s*, &c., of which there is one over each nipple. The other end of the lever, *r*, is moved by the pin, *t*, fixed in the hammer, and so adjusted that as the hammer rises, the lever is out of the notch, *s*, and the chamber released, before the ratchet is made to revolve by the lever, *n*. Whilst the hammer remains at half cock, the lever is clear of the notch, and the chamber can be freely revolved and loaded. Before the hammer is brought to full cock, the pin, *t*, passes the end of the lever, *s*, and the lever being released, is forced by the spring, *u*, into the notch, *s*, to hold the barrel in the right position at the moment of firing.

This spring is divided into two parts; one, *u*, acting on the lever, *r*, and the other, *u'*, acting on the trigger, to keep it in contact with the hammer.

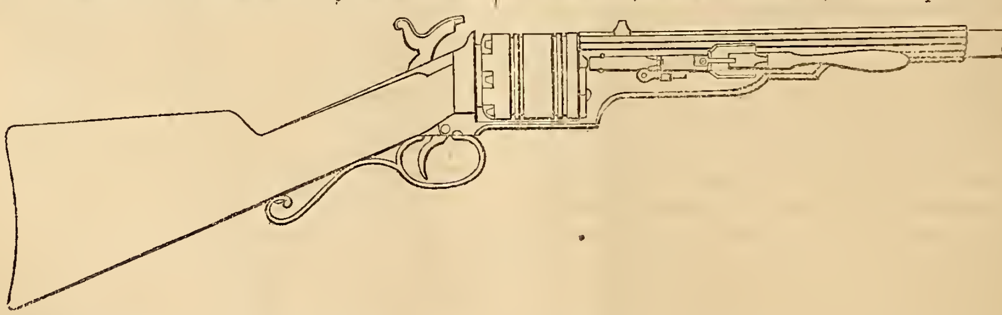
After the pin, *t*, has passed the end of the lever, *r*, in going up, it is obvious that it could not repass it in coming down, unless some provision were made for that purpose. This is effected by splitting the end of the lever, *r*, in two pieces (as shown in fig. 5), on the inner of which only, the pin, *t*, acts. The point of the pin is also bevilled, so that in its descent, it collapses the two pieces of the lever, *r*, and passes them, their elasticity keeping them extended after it has passed.

Method of use.—Having thus described the details of construction, it remains to say a few words on the method of using this arm. The rapidity with which it can be loaded is not one of the least of its recommendations. The hammer is half-cocked, which sets the chamber at liberty, as we have before described, and the powder is poured into each receptacle in the chamber in succession, the balls being put on the powder without any wadding, and rammed down by the lever ram-rod. The chamber is not rifled, and, therefore, there is no difficulty in ramming the balls home, whilst the damage to the sharp edges of the grooves, which always takes place in ordinary rifles, from the force with which the ramrod must be used, is entirely avoided.

A very effectual provision is made to prevent the accidental discharge of this pistol whilst being carried in the pocket or belt. Between each nipple (see fig. 3) is a small pin, and the point of the hammer has a corresponding notch, so that if the hammer be lowered on to the pin, the chamber is prevented from revolving, and the hammer is not in contact from the percussion cap, so that even if the hammer be struck violently by accident, it cannot explode the cap.

The hammer, when at full cock, forms the sight by which to take aim, and it is readily raised to full cock by the thumb, without using both hands. As we have tested from actual experience, this arrangement is superior to those imitations of Mr. Colt's pistols, in which the hammer is raised by pulling at the trigger, the strength of the pull necessary for this purpose interfering with the correctness of aim, which is of so much importance.

The bullet mould, powder flask, and screw driver, form the only other fittings necessary for the pistol case. Figs. 6 and 7 are a plan and elevation of the bullet mould, which is formed of brass, and is provided with a mould for the conical ball, as well as the ordinary spherical one. The plate, *u*, which forms the cover of the mould, is made of steel, and the hole through which the lead is poured has a knife edge, so that after the ball is cast, by moving the cover as shown in fig. 6, the runner on the ball is cut off. Fig. 8 is an elevation, and fig. 9 a plan of the upper end of the powder flask, the mouthpiece of which is fitted with a bayonet joint, by which the supply of powder can be adjusted by shifting the mouthpiece to $\frac{3}{4}$ or $\frac{5}{8}$ of a drachm, &c., according to the several sizes of the arm. Figs. 10 and 11 show the screw driver, one end of which fits the nipples, and the other the ordinary screw head. The same principle has been applied by Mr. Colt to a carbine, which, from the facility which it offers for loading, seems particularly well adapted for cavalry. The accompanying engraving represents it in elevation. The only alteration in the arrangement, is the position of the ram-rod, which, in this case, is on the side of the barrel, instead of below it, as in the pistol.



MODERN IMPROVEMENTS IN FIRE ARMS.*

Modern fire arms, as used for purposes of war, are just now in a transition state. Since the invention of the percussion lock, but little attention has been paid in this country to their improvement. The ill concealed contempt with which purely scientific attempts at improvement are received by those who make their only boast of being "practical men," is no where so prevalent as in this country, and accordingly we find that whilst we have remained stationary, the great continental military powers and the United States, have not only availed themselves of each improvement as it appeared, but have stimulated invention by liberal patronage. The result of this obstinate adherence to an antiquated system has fortunately not yet been tested by an European war. Can we doubt what would be the result of an engagement between two bodies of troops, one armed with the English musket, and the other with the needle gun, which, taking the number of shots only into account is $3\frac{1}{2}$ times as effective? Or, in the case of a frigate engagement, what would be the fate of any boarding party, having to face a body of men armed with Colt's "six shooters?" What an eager rush would there be to wipe off the burning disgrace! What sums would be squandered in trying to do that in a few months which had occupied other nations years. The "practical men" no doubt would attempt to console us, by calculating how many needle guns and revolvers had got out of order during the campaign, and how bravely English soldiers

* *Observations on the Past and Present State of Fire Arms*, by Col. Chesney, R.A. London: Longman. 8vo., pp. 376.
Projectile Weapons of War, by John Scoffern, M.B. Second Edition, 12mo., pp. 213 London: Cooke and Whitley.

stood up to be shot at by an almost invisible enemy. There are some signs of a tardy repentance amongst those "in high places" it is true, but we would ask, is the only use of an executive to obstruct improvement? Is it not rather bound to originate? or must that department be left to the unassisted and disunited efforts of unprofessional men? It will hardly be credited, but we are informed on good authority, that the Ordnance have just refused the occasional use of their exercising ground to a committee of gentlemen desirous of practically testing the merits of the different modern fire arms. When the difficulty, we may say almost the impossibility, of obtaining any other piece of ground, three quarters of a mile in length (and it ought not to be less for *testing* rifles) in a suitable locality, we may well be astonished at the refusal.

Having thus shown what our authorities have *not* done, we will endeavour to extract from the two works before us, what other nations *have* done.

Colonel Chesney's work gives us a history of the invention and progress of artillery from the earliest times; the present state of continental artillery and our own — the needle gun, and the change of tactics which its introduction will enforce. Much of this matter, although valuable, is interesting only to the professional man. We are rather concerned with the mechanical details of the various systems, which are explained clearly and without bias, a favourable and not very frequent feature in a work written by a professional man. In our last (*ante* p. 77) we gave Colonel Chesney's description of the needle gun, which, from its rapidity of firing, he appears to consider entitled to the preference. Those who may not agree with the author on this point will yet admit that it is expedient to take a high standard with which to compare the efficiency of our light artillery, which appears likely to be superseded by an arm which admits of equal range, is of even greater accuracy, and of universal applicability.

Captain Wittich infers that the needle gun will give infantry an increased advantage over cavalry, and that, therefore, the latter may be in a great measure dispensed with. He would therefore employ *mounted infantry*, armed with the needle gun, using the horse merely as a means of rapid locomotion. Colonel Chesney appears to incline to the same plan, and says, "The important services recently rendered by the irregular horse in India may give some idea of what can be done, and the writer has seen the men of Skinner's Horse break several bottles by the fire of their matchlocks, as they passed in succession at a gallop."

Dr. Scoffern gives us a brief but interesting account of the early history of projectile weapons of war,—the bow, cross-bow, battering-ram, Greek fire, &c. From his account of the manufacture of gunpowder, we may make a few extracts:—

The saltpetre of commerce contains various impurities which would materially affect the quality of the powder. It is therefore dissolved in water, the earthy matter allowed to settle, whilst the nitrate of lime, chloride of sodium, calcium, and some other salts, are got rid of by taking advantage of the difference between their solubility in water, and the solubility of the saltpetre. Saltpetre is more soluble in boiling water than in cold; chloride of sodium (common salt), is not; therefore, by drawing off the saltpetre at a high temperature, the common salt is left behind. Again, chlorides of calcium and magnesium, the nitrates of lime and soda, are more soluble in water, hot or cold, than is saltpetre; therefore the latter crystallizes, leaving the former in solution. The next step is to fuse the saltpetre, to drive off any water which may have become *entangled* amongst its particles (it does not contain any water *chemically united*), and thereby enabling it to be weighed with accuracy. It would be well if this operation could be dispensed with, as the application of too high a temperature drives off oxygen, and binoxide of nitrogen, and materially injures the substance.

The sulphur is purified either by simple fusion, the impurities sinking to the bottom, or by sublimation. The greatest improvement in modern times has been in manufacturing the charcoal. It was formerly burnt in a pit, and covered merely with turf; on this system, sufficient heat could not be applied to drive off the volatile substances without consuming the charcoal. The modern system is to distil the wood in cast-iron retorts, set as in a gas-work, by which means all the pyroligneous acid and tar in the wood are saved, and a superior quality of charcoal is produced.

The ingredients, after being pulverized, are mixed under edge runners, a little water being added, which, with the trituration, reduces the powder to mill-cake. The cake is then compressed in a hydraulic press, although an excess of pressure must be avoided, as it would make the powder so dense as to diminish its facility of ignition. It has then to be grained, which is done in the following manner:—Sieves, covered with strong parchment formed out of bullocks' hides, perforated with small holes, are put in rapid motion by means of suitable machinery. The mill-cake is put into these sieves, along with discs of lignum vitæ, the motion of which drives the powder in grains through the perforated bottom of the sieve. The powder is then dried by steam heat, and glazed by being violently shaken in a revolving barrel. The grains are formed of various sizes, which are separated in sieves, the larger sized being used for cannon, and other purposes where a large bulk is used together.

Our fore-fathers, though not having our improved machinery, went very skilfully to work. They took care to use the softest woods for their charcoal, and they effected a very perfect mixture of the materials by taking advantage of a property which saltpetre has. This salt may be obtained in an impalpable powder, by dissolving the crystals in the smallest possible quantity of water, and then applying heat to vaporize this water, stirring the solution all the time incessantly. To mix the ingredients the saltpetre was first dissolved, the sulphur and charcoal added, and the whole incessantly stirred. No compression was used. The following are the proportions of the ingredients in use:—

MINER'S POWDER.

	Atoms.	Theory (per cent.)	Practice (pr. ct.)	Results of Combustion.	Atoms.
1 Nitre	102	63.35	65	Bisulphuret of Potassium....	12
2 Sulphur	32	19.87	20	1 Nitrogen	14
$4\frac{1}{2}$ Carbon	27	16.77	15	$1\frac{1}{2}$ Carbonic Acid	33
				3 Carbonic Oxide	42
Total	161	100.00	100	Total......	101

FINE SHOOTING POWDER.

	Atoms.	Theory (per cent.)	Practice (pr. ct.)	Results of Combustion.	Atoms.
4 Nitre	408	77.71	78	3 Sulphuret of Potassium....	168
3 Sulphur	48	9.14	10	1 Carbonate of Potash	70
$11\frac{1}{2}$ Carbon	69	13.14	12	4 Nitrogen	58
				$10\frac{1}{2}$ Carbonic Acid	231
Total	525	99.99	100	Total......	525

COMMON SHOOTING POWDER.

	Atoms.	Theory (per cent.)	Practice (pr. ct.)	Results of Combustion.	Atoms.
1 Nitre ....:	102	75	75	1 Sulphuret of Potassium....	56
1 Sulphur	16	11.76	12.5	1 Nitrogen	14
3 Carbon	18	13.23	12.5	3 Carbonic Acid ..	66
Total	136	99.99	100.0	Total......	136

MODERN ENGINEERING TOOLS.

(Illustrated by Plate 7.)

The self-acting tools at the Great Exhibition formed one of the most interesting classes to men of scientific taste; but whilst there was much that was excellent, there was little that was new to the engineer, already acquainted with the productions of Manchester and Leeds. Small planing machines were abundant, but there were none of the heaviest class, which is readily accounted for, when their cost and comparative unsaleable character is taken into account. As a contribution to our stock of engineering tools, we have great pleasure in adding one of a first-class character, which, although constructed by a French engineer —M. Nillus, of Havre—was designed by an English engineer of eminent practical ability, Mr. James Paul, who has recently left France to assume a responsible situation in the Danube Steam Navigation Co. The original millwright's planing machine, as many of our readers will recollect, consisted of a light frame, which was placed over the work to be planed, and which carried a tool holder, which was pushed along by main force, or, for heavy cuts, worked along by a screw and a winch handle. This gave place to the modern machine, in which the tool is fixed, and the work moves with the table on the bed of the machine. For small work, this plan has greater convenience; but when heavy articles, such as the sole plates of engines, girders, &c., have to be planed, serious objections arise. The table and bed require to be of corresponding strength and weight; and the friction of the mass is considerable. The momentum also becomes serious, and the speed at which the planing is done is limited, not by the endurance of the tool, as in a lathe, but by the safety of the machine. These causes induced Mr. Paul, in designing a machine for the heaviest class of work, to revert to the old system of fixing the work and moving the tool, which he has worked out very efficiently in the example before us.

A pit, lined with masonry, extends under the machine, and is lined at certain intervals with cast iron plates, which serve to carry the moveable transverse girders, to which the work is attached and which can be placed at various heights.

The table carrying the tools, slides on the bed, and is moved by two screws, one on each side, which are connected to the prime mover by bevel gear, straps, and pullies, as is well understood. These screws do not extend the whole length of the bed, but are short pieces let into the table, and slide on two shafts which give them motion. The screw contains a feather and the shaft a keyway, so that whilst the shaft drives the screw, it permits of its motion with the table along the bed of the machine. On each side of the bed of the machine is a rack into which the screw takes, and thus all the jar, which is always visible when using an ordinary rack and pinion for driving a planing machine, is entirely avoided.

It is necessary to remark that in the side and end elevations, the full depth of the pit is not shown. This is also the case with the bed of the machine, which, as constructed, is 24 feet long.

FIRE INSURANCE, *VERSUS* WATER SUPPLY.

We learn from the papers that a few days since a formidable fire in the centre of Croydon was speedily extinguished by the application of the constant supply of water at high pressure, which that town now enjoys.

When the Metropolis will be similarly favoured it would be difficult to guess, but seeing that our present fire engines never save the building in which the fire originates, it would not be difficult to show that the saving in fire insurance would more than pay for the capital required for our water supply. We hear that the inefficiency of even the floating engines was so apparent at the late great fire at London Bridge, that it has been determined to fit one of them with steam power. This plan was adopted by the West India Dock Company some years since, and were it applied to a few of our river steamers, would give us, in any one of them, a water battery before which no fire could exist for a quarter of an hour.—

ON THE CALCULATION OF ENGINE POWER.

In many cases it will be found useful to possess a ready means for calculating the greatest amount of power an engine is capable of performing, at any velocity, or at any rate of expansion. In the earliest time of steam-engineering, the real power of a steam-engine was fairly equal to its nominal power. But this time is gone. The pressure and rate of expansion have been gradually increasing, as well as the velocity of the piston. So that, on calculating the dimensions of an engine, required for any amount of work, the real power must be taken into account. This is especially the case when the engine should work at any considerable degree of expansion, and at a greatly increased velocity, as in Mr. Bourne's Double-Power Steam Engines.* For this purpose, the following tables are calculated, which show at a glance, the useful pressure of steam on the piston, at different pressures and at different degrees of expansion, when the engine is exerting its utmost power—*i. e.*, when the steam in the boiler has an equal pressure as that in the cylinder, or nearly so. They may answer also the purpose of calculating the dimensions of engines of equal power, but working at different pressures.

These tables will be found especially useful for readily ascertaining to what degree of expansion any engine may be worked, without decreasing in velocity, to move the same load. Taking as an example, a condensing-engine and boiler, calculated to carry 20 lbs. of steam per square inch above the atmosphere, the diameter of the cylinder being 48 inches, and expansion beginning when the piston has performed $\frac{7}{8}$th parts of its stroke. Now, causing the steam in the boiler to fall down to the point at which the piston can only just maintain its *required velocity*, and, finding by the steam gauge the pressure (as may frequently be the case) to be 10 lbs. per square inch, then this pressure is that at which the engine is working with its maximum of useful effect for the load then to be moved. Now, as to the table, the useful pressure on the piston of a 48-inch cylinder, with a pressure in the boiler of 10 lbs. per square inch, and expanding at $\frac{7}{8}$th parts of the stroke, will be found to amount to 19.71 lbs. per square inch. When the engine now should be worked at its greatest pressure in the boiler —viz., 20 lbs. per square inch, so that the useful pressure on the piston will be about equal to 19.71 lbs. per square inch, we must find at which degree of expansion the useful pressure on the piston of a 48-inch cylinder, and with a load of 20 lbs. per square inch on the safety valve, will be about equal to 19.71 lbs. per square inch. On referring to table A, it will be found that the expansion can begin on the $\frac{3}{8}$th part from the beginning of the stroke; for, in that case, the useful pressure on the piston will amount to nearly 20 lbs. on the square inch.

By the tables of relation between the space passed through by the piston and the quantity of water to be provided to the boiler, the economy of fuel to be gained by working the engine expansively to this extent, may be readily ascertained. For, taking the same example as above, on referring to the table C, the volume of water to be delivered by the feed-pump is to the space passed through by the piston, at a pressure of 10 lbs. per square inch, and expanding during $\frac{1}{8}$th part of the stroke, as 0·00090406 : 1, and at a pressure of 25 lbs., but expanding during $\frac{5}{8}$th part of the stroke, as 0·00065107 : 1. Now, the velocity and area of piston remaining the same, the quantity of water to be provided to the boiler, is in both cases respectively, about as 0·0009 : 0·00065, or in round numbers as 18 : 13—showing a saving of nearly 28 per cent.

The friction of a steam-engine varies inversely as the diameter of the cylinder; therefore, the useful pressure is calculated for different diameters. It ought, however, to be stated, that this is merely done for showing, in a practical manner, that this friction is smaller in proportion to the total pressure, in cylinders of any considerable dimen-

* Vide *Artizan*, "Treatise on the Steam-Engine." Third Edition, p. 178.

sions, than in those which are smaller. In practice this slight difference can nearly not be taken in account, as the amount of friction even in the same engine, is never a constant quantity, but varies with the more or less careful management of the engine. Accordingly, the numbers in the tables should then be regarded as corresponding to the most favourable condition of engines, and it will, therefore, be safe to take always the pressure corresponding with the smallest cylinders.

Though I am well aware that the useful pressure on the piston may also be calculated by making a due deduction from the total pressure for friction and other resistances, it may yet be found convenient to make use of the annexed tables, the more as the friction occasioned by the load amounts (as to the experiments of M. de Pambour) to about 1-7th of the resistance caused by the load. These deductions, varying accordingly with the pressure, must be made for each different pressure; and as the tables are made up for pressures generally made use of, they may save a small quantity of labour.

The tables are made up from formulæ, as given by M. de Pambour, in his *Théorie des Machines à Vapeur*, viz.:—

Table A, for condensing non-expansive rotative engines—

$$r = \frac{1}{1+\delta}\left(\frac{P\text{-}p\text{-}f}{144}\right)$$

For condensing expansive rotative engines—

$$r = \frac{1}{1+\delta}\left\{\frac{\frac{l'+c}{l}\,k\,(250+P)-(250+p+f)}{144}\right\}$$

Where r represents the useful pressure of steam on the piston in lbs. per square inch, $\frac{l'}{l}$ proportion of stroke, made before the steam is cut off; k, co-efficient, varying with the quantity $\frac{l'}{l}$. P, represents the total pressure of steam in the boiler, equal to the load on the safety valve + atmospherical pressure; p, pressure of the uncondensed vapour in the cylinder, taken at 1·5 lbs per square inch (27 inches of mercury being an average of good engines); f, friction of the unloaded engine, taken at 0.75 lb. per square inch for a 33-inch cylinder, and varying inversely with the diameter, all in pounds per square foot. δ, represents the additional friction occasioned by the load, and as stated above, taken at 1-7th of the resistance; $c = 0.50\,l$, being a deduction of 1-20th of the cylinder's capacity, for the steam ports, and the clearance at each end of the cylinder.

The formulæ from which Table B has been calculated, are as follows:—

For non-condensing, non-expansive rotative engines—

$$r = \frac{1}{1+\delta}\left[\frac{P-f-2118}{144}\right]$$

And for non-condensing expansive rotative engines—

$$r = \frac{1}{1+\delta}\left\{\frac{\frac{l'+c}{l}\,k\,(620+P)-(2738+f)}{144}\right\}$$

Where the same notation has been adopted as in the last given formulæ. The formulæ from which Tables C and D are calculated, are as follows:—

For condensing non-expansive engines $S=\frac{250+P}{3{,}904{,}700}$

" " expansive " $S=\frac{l'+c}{l}\;\frac{250+P}{4{,}100{,}000}$

For non-condensing non-expansive engines $S=\frac{620+P}{4{,}140{,}950}$

" " expansive " $S=\frac{l'+c}{l}\;\frac{620+P}{4{,}348{,}000}$

Where the same signs represent the same values as above.

By multiplying the number found in the table for any required pressure and degree of expansion, by the piston's velocity per minute in *feet*, and by its area in square *feet*, the number of cubic feet of water to be delivered by the feed-pump per minute, is readily found. Only 19-20ths of this quantity is required for passing in the form of steam through the cylinder, the remaining twentieth part being allowed for priming and waste.

Table *of useful Pressure of the Steam on the Piston, in pounds per square inch, at different Pressures, different degrees of Expansion, and at different dimensions of Cylinder.*

A.—CONDENSING ENGINES.

Diameter of Cylinder in inches.	No Expansion.						
	12	18	24	36	48	72	96
Load on the Safety Valve in pounds per square inch. 6	15·01	15·62	15·93	16·23	16·38	16·54	16·62
8	16·77	17·38	17·68	17·99	18·14	18·29	18·37
10	18·52	19·13	19·43	19·74	19·89	20·00	20·11
12	20·28	20·89	21·19	21·50	21·65	21·80	21·88
15	22·91	23·51	23·82	24·18	24·28	24·43	24·50
20	27·67	27·90	28·20	28·51	28·66	28·81	28·89
25	31·68	32·29	32·59	32·89	33·05	33·20	33·29
30	36·06	36·67	36·98	37·28	37·43	37·59	37·67

Diameter of Cylinder in inches.	Steam cut off at $\frac{7}{8}$th of the Stroke.						
	12	18	24	36	48	72	96
Load on the Safety Valve in pounds per square inch. 6	14·86	15·47	15·77	16·08	16·23	16·38	16·46
8	16·60	17·21	17·51	17·82	17·97	18·12	18·20
10	18·34	18·95	19·25	19·58	19·71	19·86	20·00
12	20·08	20·69	20·99	21·30	21·45	21·60	21·68
15	22·69	23·30	23·60	23·91	24·06	24·21	24·29
20	27·04	27·65	27·95	28·26	28·41	28·56	28·64
25	31·39	32·00	32·30	32·61	32·76	32·91	32·99
30	35·74	36·35	36·66	36·96	37·11	37·27	37·34

Diameter of Cylinder in inches.	Steam cut off at $\frac{3}{4}$ths of the Stroke.						
	12	18	24	36	48	72	96
Load on the Safety Valve in pounds per square inch. 6	14·37	14·98	15·28	15·59	15·74	15·89	15·97
8	16·07	16·67	16·98	17·28	17·44	17·59	17·67
10	17·76	18·37	18·67	18·98	19·13	19·28	19·36
12	19·46	20·05	20·37	20·68	20·83	20·98	21·06
15	22·00	22·61	23·00	23·22	23·37	23·52	23·61
20	26·25	26·86	27·16	27·46	27·62	27·77	27·85
25	30·49	31·10	31·40	31·71	31·86	32·01	32·09
30	34·73	35·34	35·64	35·95	36·10	36·25	36·33

Diameter of Cylinder in inches.	Steam cut off at $\frac{5}{8}$ths of the Stroke.						
	12	18	24	36	48	72	96
Load on the Safety Valve in pounds per square inch. 6	13·50	14·11	14·41	14·72	14·87	15·02	15·10
8	15·12	15·73	16·03	16·34	16·49	16·64	16·72
10	16·74	17·35	17·65	17·96	18·11	18·26	18·34
12	18·36	18·95	19·27	19·58	19·73	19·88	19·96
15	20·79	21·40	21·70	22·00	22·16	22·31	22·39
20	24·84	25·44	25·75	26·05	26·21	26·36	26·44
25	28·96	29·57	29·87	30·18	30·33	30·48	30·56
30	32·93	33·54	33·85	34·15	34·30	34·46	34·53

TABLE A, Continued.

Diameter of cylinder in inches.	Steam cut off at ½ of the Stroke.						
Load on the Safety Valve in pounds per square inch.	12	18	24	36	48	72	96
6	12·17	12·78	13·08	13·39	13·54	13·69	13·77
8	13·67	14·27	14·58	14·88	15·04	15·19	16·27
10	15·17	15·77	16·08	16·38	16·54	16·69	16·77
12	16·67	17·26	17·58	17·88	18·04	18·19	18·27
15	18·92	19·52	19·83	20·14	20·29	20·44	20·52
20	22·67	23·28	23·58	23·88	24·04	24·19	24·27
25	26·42	27·03	27·33	27·64	27·79	27·94	28·02
30	30·17	30·78	31·08	31·39	31·54	31·69	31·77

Diameter of cylinder in inches.	Steam cut off at ⅜ths of the Stroke.						
Load on the Safety Valve in pounds per square inch.	12	18	24	36	48	72	96
6	10·28	10·89	11·19	11·49	11·65	11·80	11·88
8	11·61	12·22	12·52	12·83	12·98	13·13	13·21
10	12·94	13·55	13·85	14·16	14·31	14·46	14·54
12	14·28	14·87	15·20	15·50	15·65	15·80	15·88
15	16·27	16·88	17·18	17·49	17·64	17·79	17·87
20	19·60	20·21	20·51	20·82	20·97	21·12	21·20
25	22·93	23·54	23·84	24·15	24·30	24·45	24·53
30	26·26	26·87	27·17	27·48	27·63	27·78	27·86

Diameter of Cylinder in inches.	Steam cut off at ¼th of the Stroke.						
Load by the Safety Valve in pounds per square inch.	12	18	24	36	48	72	96
6	7·64	8·25	8·56	8·86	9·01	9·17	9·25
8	8·74	9·35	9·65	9·96	10·11	10·26	10·34
10	9·84	10·45	10·75	11·06	11·21	11·36	11·44
12	10·94	11·53	11·85	12·15	12·31	12·46	12·54
15	12·58	13·19	13·49	13·80	13·95	14·10	14·18
20	15·32	15·93	16·24	16·54	16·70	16·85	16·93
25	18·07	18·68	18·98	19·29	19·44	19·59	19·67
30	20·81	21·42	21·73	22·03	22·18	22·33	22·41

B—NON-CONDENSING ENGINES.

Diameter of Cylinder in inches.	No Expansion.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	35·81	37·03	37·36	38·25	38·55	38·85
50	40·19	41·41	43·02	42·63	42·94	43·24
55	44·35	45·80	46·41	47·01	47·32	47·60
60	48·97	50·18	50·79	51·41	51·71	52·02
65	53·35	54·58	55·18	55·79	56·09	56·40
70	57·74	59·23	59·57	60·17	60·48	60·78
75	62·13	63·34	63·95	64·57	64·87	65·17
80	66·45	67·73	68·28	68·95	69·25	69·56
90	75·28	76·50	77·11	77·78	78·03	78·39

Diameter of Cylinder in inches.	Steam cut off at ⅞ths of the stroke.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	35·36	36·57	37·19	37·80	38·11	38·41
50	39·72	40·92	41·54	42·15	42·46	42·76
55	44·06	45·27	45·89	46·50	46·80	47·11
60	48·40	49·61	50·23	50·84	51·14	51·45
65	52·77	53·98	54·60	55·21	55·51	55·82
70	57·06	58·27	58·89	59·50	59·80	60·11
75	61·47	62·68	63·30	63·91	64·21	64·52
80	65·82	67·03	67·65	68·26	68·56	68·87
90	74·53	75·74	76·36	76·97	77·27	77·46

TABLE B, Continued.

Diameter of Cylinder in inches.	Steam cut off at ¾ths of the Stroke.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	33·97	35·18	35·80	36·41	36·71	37·02
50	38·21	39·42	40·04	40·65	40·95	41·26
55	42·45	43·66	44·28	44·89	45·19	45·50
60	46·70	47·91	48·53	49·14	49·44	49·74
65	50·94	52·15	52·77	53·38	53·68	53·99
70	55·12	56·33	56·95	57·56	57·86	58·17
75	59·42	60·63	61·25	61·86	62·16	62·47
80	63·67	64·88	65·50	66·10	66·41	66·71
90	72·16	73·37	73·80	74·59	74·90	75·20

Diameter of Cylinder in inches.	Steam cut off at ¼th of the Stroke.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	14·79	15·99	16·61	17·22	17·53	17·83
50	17·53	18·74	19·36	19·96	20·27	20·57
55	20·27	21·48	22·10	22·71	23·01	23·32
60	23·02	24·23	24·84	25·45	25·76	26·06
65	25·76	26·97	27·59	28·20	28·50	28·81
70	28·47	29·67	30·29	30·90	31·21	31·51
75	31·25	32·46	33·07	33·68	33·99	34·29
80	33·99	35·20	35·82	36·43	36·73	37·04
90	39·48	40·69	41·31	41·92	42·22	42·53

Diameter of Cylinder in inches.	Steam cut off at ⅜ths of the Stroke.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	22·29	23·50	24·12	24·73	25·04	25·34
50	25·62	26·83	27·45	28·06	28·36	28·67
55	28·95	30·16	30·78	31·39	31·69	32·00
60	32·29	33·50	34·11	34·72	35·03	35·33
65	35·62	36·83	37·44	38·05	38·36	38·66
70	38·90	40·11	40·73	41·34	41·64	41·95
75	42·28	43·48	44·10	44·71	45·02	45·32
80	45·61	46·82	47·43	48·04	48·35	48·65
90	52·27	53·48	54·10	54·70	55·01	55·32

Diameter of Cylinder in inches.	Steam cut off at ½ of the Stroke.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	27·68	28·89	29·52	30·13	30·49	30·74
50	31·43	32·64	33·26	33·87	34·23	34·48
55	35·18	36·39	37·01	37·62	37·98	38·23
60	38·94	40·15	40·77	41·37	41·73	41·98
65	42·69	43·90	44·52	45·13	45·48	45·74
70	46·39	47·60	48·22	48·83	49·18	49·43
75	49·92	51·15	51·77	52·38	52·74	52·99
80	53·94	55·15	55·77	56·38	56·74	56·99
90	61·45	62·66	63·28	63·89	64·24	64·50

Diameter of Cylinder in inches.	Steam cut off at ⅝ths of the Stroke.					
Load on the Safety Valve in pounds per square inch.	6	9	12	18	24	36
45	31·49	35·54	33·32	33·93	34·23	34·54
50	35·54	36·75	37·37	37·98	38·28	38·59
55	39·59	40·79	41·41	42·02	42·33	42·63
60	43·64	44·85	45·47	46·08	46·38	46·68
65	47·69	48·90	49·51	50·12	50·43	50·73
70	51·68	52·89	53·51	54·12	54·42	54·73
75	55·78	56·99	57·61	58·22	58·52	58·83
80	59·83	61·04	61·66	62·27	62·57	62·88
90	67·95	69·14	69·76	70·37	70·68	70·98

Tables showing the relation between the space passed through by the piston, and the quantity of water to be provided to the boiler.

C.—CONDENSING ENGINES.

Load on the Safety Valve in pounds per square inch.	No Expansion.	Steam cut off at $\frac{7}{8}$th of the Stroke.	Steam cut off at $\frac{3}{4}$th of the Stroke.	Steam cut off at $\frac{5}{8}$th of the Stroke.	Steam cut off at $\frac{1}{2}$ of the Stroke.	Steam cut off at $\frac{3}{8}$th of the Stroke.	Steam cut off at $\frac{1}{4}$th of the Stroke.	Load on the Safety Valve in pounds per square inch.
6	0·0008710	0·00076727	0·00066358	0·00055990	0·00045621	0·00035253	0·00024885	6
8	0·00094862	0·00083568	0·00072275	0·00060981	0·00049689	0·00038396	0·00027103	8
10	0·0010262	0·00090406	0·00078190	0·00065972	0·00053755	0·00041538	0·00029321	10
12	0·0011039	0·00097246	0·00084098	0·00070963	0·00057821	0·00044681	0·00031539	12
15	0·0012204	0·0010750	0·00092978	0·00078450	0·00063921	0·00049394	0·00034876	15
20	0·0014144	0·0012460	0·0010776	0·00090926	0·00074089	0·00057250	0·00040422	20
25	0·0016085	0·0014170	0·0012255	0·0010340	0·00084256	0·00065107	0·00045958	25
30	0·0018026	0·0015880	0·0013734	0·0011588	0·00094425	0·00072965	0·00051504	30

D.—NON-CONDENSING ENGINES.

Load on the Safety Valve in pounds per square inch.	No Expansion.	Steam cut off at $\frac{7}{8}$th of the Stroke.	Steam cut off at $\frac{3}{4}$th of the Stroke.	Steam cut off at $\frac{5}{8}$th of the Stroke.	Steam cut off at $\frac{1}{2}$ of the Stroke.	Steam cut off at $\frac{3}{8}$th of the Stroke.	Steam cut off at $\frac{1}{4}$th of the Stroke.	Load on the Safety Valve in pounds per square inch.
45	0·0023430	0·0020640	0·0017851	0·0015062	0·0012282	0·00094832	0·00066940	45
50	0·0025260	0·0022252	0·0019245	0·0016238	0·0013231	0·0010222	0·00072168	50
55	0·0027089	0·0023865	0·0020638	0·0017414	0·0014189	0·0010964	0·00077395	55
60	0·0028922	0·0025479	0·0022035	0·0018592	0·0015149	0·0011706	0·00082630	60
65	0·0030752	0·0026992	0·0023429	0·0019768	0·0016107	0·0012446	0·00087860	65
70	0·0032558	0·0028682	0·0024804	0·0020928	0·0017053	0·0013177	0·00093016	70
75	0·0034413	0·0030316	0·0026218	0·0022121	0·0018025	0·0013928	0·00098317	75
80	0·0036242	0·0031929	0·0027613	0·0023298	0·0018984	0·0014669	0·0010355	80
90	0·0039906	0·0035156	0·0030403	0·0025652	0·0020902	0·0016152	0·0011401	90

Though scarcely necessary, let it, as for exemplifying the tables, be required to know the utmost power an engine of the following dimensions is capable of:—Diameter of cylinder 30 inches, velocity of piston per minute 220 feet, load on the safety valve 20 lbs. per square inch; steam cut off at half-stroke. On referring to table A, we find the useful pressure on the piston at that pressure, and rate of expansion to be between 23.58 and 23.88 lbs. per square inch, say 23 lbs.

$$\text{Now, H.P.} = \frac{\text{area of piston} \times \text{useful pressure} \times \text{velocity of piston}}{33000}$$

$$= \frac{706.86 \times 23 \times 220}{33000} = 108.$$

The quantity of water to be evaporated per minute may be found from table C.

Hence, volume of water in cubic feet = area of piston in square feet × velocity of piston × 0.0074089 = 0.79867942: say, 0.8 cubic feet per minute. This is the number of cubic feet to be actually delivered by the feed pump; the quantity required per hour will be accordingly, 0.8 × 60 = 48 cubic feet.

The dimensions of the cylinder for any given power and pressure may also readily be found by subverting the operation.

The useful pressure at the highest degrees of expansion for the lowest pressures, though impracticable, are only added as for completting the tables.

Should the above tables but prove useful to a few, I shall be fully rewarded for my labour.

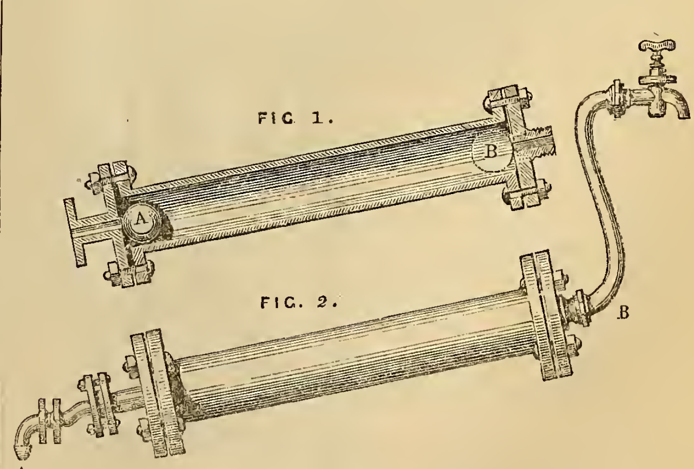
H. C. BOSSCHA, M.E.

Deventer, Holland,
March 20, 1852.

PILBROW'S WATER WASTE PREVENTER.

A STRONG objection always urged against the constant supply of water system, has been the loss which the Companies are always liable to sustain through the carelessness or malice of those who have it in their power to set the water running, and leave it so. The Companies of course have one remedy, which monopolists are never slow to employ—that is, to charge enough to cover all risks. It is, however, a point of vital importance to remove this objection; and we are glad to see that the want has produced a supply.

It may be described as a small cistern which, when once emptied, cannot be again refilled without shutting-off the delivery. Fig. 2 is a side elevation of this apparatus, in which A is the suction, and B the delivery pipe. Fig. 1 is a section, showing the method of action. The cylinder contains a ball-valve, which when the water is at rest, remains at the suction end, as at A. When the delivery cock is opened to draw water, the ball slowly rises, following the current of the water, until it arrives at the top, as at B, Fig. 1, where it stops the flow of water, by covering the aperture of the pipe. To obtain a fresh supply of water, therefore, the cock must be closed, when the ball, from its specific gravity, will descend in a few moments, and admit of an additional quantity being drawn off. From the simplicity and economy of this arrangement, it deserves to be considered an important step towards obtaining that inestimable benefit—a constant water supply, which will prevent fevers and fires alike from ravaging our dwellings.



They are manufactured by Messrs. Guest and Chrimes of Rotherham, whose high pressure cock we noticed at p. 91.

BAILLIE'S PATENT VOLUTE SPRINGS.

To trace the causes which have led to many of our "wants" in the present day, would probably be more interesting than profitable, and we leave it to the author of "Stokers and Pokers" when he shall write "Buffers and Puffers," to show us pleasantly, how the iron road has taxed the ingenuity of thousands, in the attempt to satisfy its insatiable demands. Rails, wheels, fog signals, and springs, *cum multis aliis*, have in turn been instrumental in making, or breaking, fortunes.

The old fashioned carriage spring was, naturally enough, the first tried for railway purposes, but its weight and cumbersomeness showed that some substitute was wanted. A plentiful crop of these soon appeared, and at pp. 84—135, vol. 1850, examples of numerous springs are given and discussed, and we have now another variety to add to the list, which from its simplicity, compactness, and economy, appears likely to become available for a great variety of purposes.

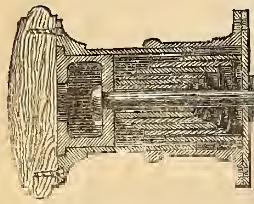


Fig. 1.

From its form it is entitled the "Volute spring," and consists, as will be seen by the sketches, of a strip of steel, tapering in width from root to point, and rolled into a volute. From the distribution of the material in the line of strain, it appears probable that this arrangement gives the maximum of effect with the minimum of material. At any rate, two great advantages are gained, the range of the spring is increased by the spiral form over the helical form, and when the spring is pressed home, it comes up to a perfectly fair bearing against the plate on which it rests.

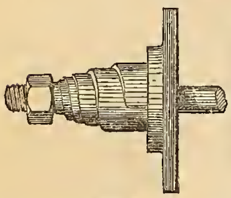


Fig. 2.

Fig. 1, is a wrought iron buffer, scale 1 inch to a foot, consisting of two cylinders, one sliding within the other.

Fig. 2 is a single draw spring for trucks or carriages, drawn to the same scale. In this instance the draw bar compresses the spring against the disc fixed on the buffer beam.

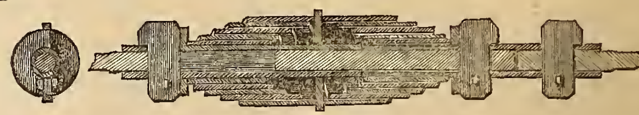


Fig. 3.

Fig, 3 is a double draw spring for a continuous rod, to the same scale. The two volutes are set, base to base, with a disc between; the draw bar and tube being slotted to allow of the requisite motion.

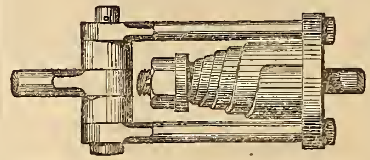


Fig. 4.

Fig 4, is a single draw-spring acting both ways, a variety in use on the waggons on the Eastern Counties Railway.

In applying these springs to the axles of carriages, they are arranged one on each side of the axle box, between it and the carriage frame, with a steadying bolt to each.

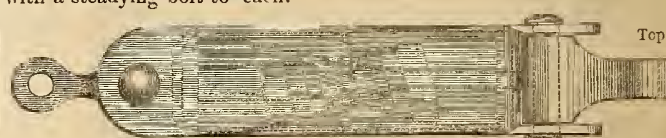


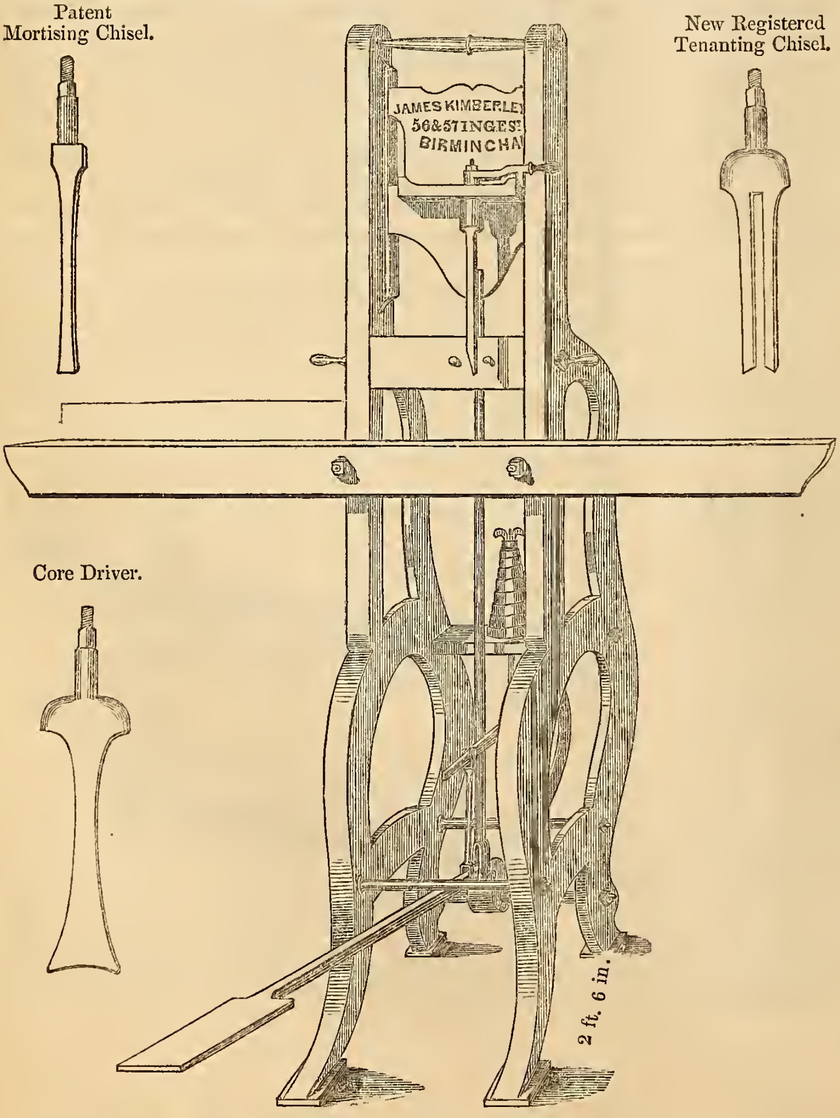
Fig. 5.

For mining purposes, these springs are used for the connections between the rope and the cage, as shown in fig. 5, and also for the cage to rest on at the bottom of the shaft. In the mine balance apparatus, shown page 25, vol. 1850, there is no provision of this kind, and consequently nothing to mitigate the concussions to which it is subjected in use, which exercise a material influence on the durability of the machinery.

Exhibition prizes have become such a bye-word, that we are not certain whether we are doing the manufacturers (Messrs. J. Spencer and Son, of Newcastle-on-Tyne) any favour by mentioning that these springs were so rewarded; and, moreover, that they were the only ones which the council, in their wisdom, thought entitled to that distinction. In this instance, however, the council were right, in our humble opinion.

Patent Mortising Chisel.

New Registered Tenanting Chisel.



Core Driver.

KIMBERLEY'S PATENT MORTISING MACHINE.

The Exhibition, amongst other good effects produced, was the means of drawing attention to the system of applying steam power to the conversion of wood into the various forms in which it is used by the carpenter and joiner. The sash-bar machine, and the gutter-making machine, were but little known except to a few large firms, and now they seem likely to have a place in every builder's-yard, who can boast of a steam engine; and who would not have such an untiring drudge, when engines can be bought at £10 per horse power! The mortising machine before us will pave the way. It does not require much description at our hands. It is, in fact, a veritable wood-slotting machine, worked by the foot of the workman. The treadle is depressed by the foot and raised by a strong volute spring on Baillie's Patent.

The tenanting chisel, it will be perceived, cuts both sides of the tenon simultaneously. The maker cautions the workman as to grinding the two edges of the chisel, bevilled, so as to obtain a drawing cut and make clean work. It is also recommended to cut the whole depth of the tenon at one stroke, as it makes truer work than when cut half down and then reversed. Our engineering friends ought to patronize this machine for their pattern shops.

COTTON AND ITS MANUFACTURING MECHANISM.

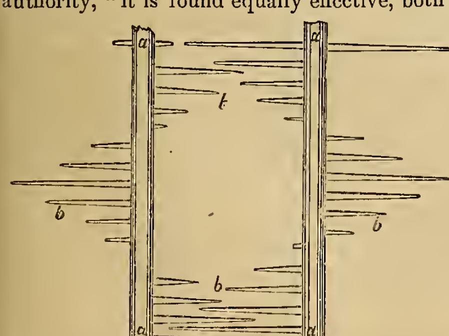
By Robert Scott Burn, M.E., Mem. S.A.

(Continued from page 26.)

We have now to notice a new machine for cleansing and opening cotton; it is designated as "Hardacre's Patent Cotton Opener."

The principle of this machine is that of the batting sticks; these being applied horizontally to a vertical shaft, revolving at a velocity of 700 to 1,000 times per minute. The cotton to be opened and cleaned is taken at once from the bales, and fed to the machine through an opening in the lid or cover; it passes between rollers and thereafter drops upon the topmost batting arm. The heavy impurities mixed with the cotton are expelled and driven through between the openings of the cage which surrounds the butting arms, this cage being formed of upright iron hooping, placed in a position with reference to the batting arms, so that it receives the lash of the cotton, which, as it is being rapidly whirled round, strikes the angular edges of the fixed vertical hoops or blades. The inner cage is surrounded by an exterior close case, the space left between them, forming receptacles for the sand and other heavy impurities; these receptacles require to be cleaned out several times daily when the machine is in full work, otherwise on becoming filled, the impurities from the cotton not finding access through the cage or grid, the cleansing action would be suspended. The dust receptacles are emptied by removing "shutter like portions of the outer case." The light portions of the impurities along with the contained dust, are carried off by the action of a rotating fan. The opened purified cotton is driven through the shoot or open passage near the bottom, and is gradually carried forward up the creeper and discharged into a basket, box, or other suitable receiver, in a light feathery state. The arms projecting from the main vertical shaft are not of irregular lengths, but are placed so as to form narrow steps, like the nosings of the step of a double geometrical staircase. The uppermost pair of batting arms are provided with vertical projecting teeth, like those of the conical willow. The following are some of the advantages said to be obtained by this machine:—first, economy in power; second, perfect expansion of the cotton without injury to the staple from the action of the points or teeth; third, the more effectual separation of the dirt, seeds, and all other extraneous matter; fourth, compact form and convenience in the mode of working—this last advantage is obviously obtained by the vertical portion of the machine, a high velocity being attainable. The patentees inform us that one machine is calculated to clean 40,000 lbs. of cotton per week of $57\frac{1}{2}$ hours, requiring at this rate only $1\frac{1}{4}$ to $1\frac{1}{2}$ horse power. We understand this estimate of its capabilities is considerably under the mark.

A modification of this machine is extensively used in America, its principal peculiarity is the employment of two vertical shafts, as *a a*, the arms, *b b*, of which intersect each other. "In America," says a good authority, "it is found equally effective, both as an opener (gin) and



a purifier, and to use the significant expression of a practical mechanic "it is more like a mowing machine than a devil." The young persons employed, have the appearance of travellers, when covered with slightly driven snow. A handful of the solid matted cotton becomes an armful, and an armful a roomful, being almost instantaneously converted into a shower of beautifully opened, whitened, and purified cotton, white as driven snow, when compared with its previous speckled appearance." With reference to the high estimation in which this machine is held by the Americans, the same writer thus writes. "It would be as impossible to persuade our transatlantic competitors to substitute the best English 'willow' for Hardacre's improved opener, as to persuade the Lancashire spinner to resume the 'batting flake."

(To be continued.)

LOCOMOTIVE ENGINEERING IN AMERICA.

BY ZERAH COLBURN.

We have just received a little work by Mr. Colburn on the Locomotive Engine, which appears accurately to represent the existing condition of American experience on the subject. Although in many respects their system differs from ours, there is still sufficient in common to both, to render an analysis of the work in question interesting to our readers.

The scarcity of bituminous coal in America, the difficulty of managing the anthracite, and the abundance of wood has led to the general use of the latter fuel, both in locomotives and steam-boats, and "wooding up" takes the place of "coaling." One advantage of wood fuel is, that it does not contain any sulphur, and therefore the durability of the boiler is slightly increased. To what extent, we are unable to say, from the want of the necessary data. The following particulars are given by Mr. Colburn:—

The tubes in wood engines are mostly of No. 14 copper, their outside diameter being usually $1\frac{3}{4}$ inch. Wrought-iron thimbles for tubes are used by most builders, generally at the fire-box end, but in some cases at both ends of the tubes. We could point to some engines having no thimbles at either end of the tubes, and which show as tight joints as many engines having thimbles. Much indeed depends upon the management of a boiler. If an engineman is in the habit of putting out his fire by throwing two or three buckets of water into the fire-box on every slight emergency, or running with the door open to regulate the fire, the contraction produced in such cases by the sudden cooling of the flue sheets often works nearly every tube loose.

A method of tightening tubes has been used by the Lowell Machine Shop, which has given good results. It is to take a short piece, say two inches in length, of No. 14 copper tube, and of such diameter as to allow of its just sliding into the mouth of the boiler tube; it is firmly united to the latter by a brazed joint an inch long. What remains of the short tube projecting out is passed through the tube sheet, which is drilled to receive it; and the portion projecting beyond the tube sheet is then turned over and headed in the usual manner. This brings the end of the boiler tube up to a tight bearing with the inside of the tube sheet.

With long copper tubes it is sometimes deemed advisable to give them a middle bearing, for which purpose a sheet is placed midway of their length, and passing up high enough to support the top row. Our opinion, however, is, that these intermediate flue sheets intercept the circulation of the water, and in some cases occasion priming. We have observed this to be the case in some of Norris's engines, which, having tubes 10 feet 8 inches long, were provided with these extra supports.

The braces which support the boiler and serve to connect it to the frame, are made either round or flat. When made round, they are about $2\frac{1}{4}$ inches in diameter, and are turned, which adds much to their appearance.

The angle iron which secures the fire-box to the frame should extend the whole length of the fire-box, if there is nothing in the way to prevent it. It should be screwed tightly to the frame, and the screws to fasten it to the fire-box should pass through the water space, being tapped through both sheets. The heads of these screws should project

outward considerably, as they are difficult to unscrew when it becomes necessary to remove them. There should be two rows of screws passing into the fire-box, one above the other; and the distance between the screws should be just sufficient to enable a wrench to be readily introduced to turn them.

The grates are always of cast iron, and are generally 4 inches deep at the centre. Their thickness is about $\frac{5}{8}$ths of an inch on their upper edge, and $\frac{3}{8}$ths of an inch at the bottom. The space between them is $\frac{3}{4}$ inch. We know of one or two engines which were found to make steam much better by placing a piece of plate iron, six or eight inches wide, across the fire-box at that end of the grates next the tube sheet. By admitting air through the whole extent of grate surface, a large quantity of cold air naturally passes up close to the side of the fire-box, below the tubes, the draft being strongest there, and, from not passing directly through the fire, escapes into the tubes before it is properly heated. As this cools the tubes, it consequently checks the formation of steam; therefore, by not admitting the air beneath the ends of the tubes, but causing all the air to pass directly through the fire, it was found that more steam could be produced with the same fuel.

The grate should be a very few inches above the bottom of the water-space around the fire-box, in order that the water below it may remain quiescent, and collect any sediment that may deposit itself there.

The junction of the inner and outer fire-box, at the bottom of the water-space, is made with a bar of wrought iron, $1\frac{1}{2}$ inches thick, having rivets passed through it, and headed on the outside of the fire-box sheets. Some, however, bend the sheet of the inner fire-box outward, until it meets that of the outer fire-box, and then rivet them together. This method, though cheaper, does not allow the water-spaces to be so readily cleared of mud and deposit.

Norris and some other southern builders construct their boilers with the top of the fire-box worked into a hemispherical form, and having a small cast-iron dome placed upon the top. This makes a very high dome, and gives a large amount of steam room; but this form of fire-box has several disadvantages, among which is the extra expense of a boiler constructed in this way, there being work about the fire-box which can be done only by very skilful workmen, and requiring much more rivetting. Again; the height of the dome is liable to make the engine top-heavy, which, in engines having large wheels, and having the boiler set pretty well up, is quite a serious objection. The dome also, from exposing so large an extent of heated surface, makes the interior of the "cab" over the foot board insufferably hot, which is by no means a trifling matter to a man who has to stand in its heat for several hours together. With all this, the size of the dome obstructs the look out of the engine man, and the diagonal brace necessary to steady it lies directly in his way. With all these objections against it, this form of dome can hardly be said to possess any advantages over the old fashioned waggon-top fire-box, having a low cylindrical dome; although it is generally considered that drier steam can be worked from a "dome boiler," as these boilers are termed.

Hinckley forms a cylindrical dome, about 22 inches diameter and 18 inches in height, about midway on the boiler between the fire-box and smoke-box. This dome has a cast iron cover of sufficient thickness to withstand the pressure of the steam, and of such size that the aperture which it closes may admit a man to the interior of the boiler. The steam pipe and throttle are placed on one side of the dome, so as not to obstruct the passage. The dome is made of the same iron as the shell of the boiler, is lagged and covered with sheet iron in the same manner, and has a thin cast iron base and cap.

It is believed by many that a point near the smoke-box end of the boiler is the most favourable place from which to take the steam, as it is considered that the water is not in so violent a state of ebullition at that point as at the fire-box end.

The spark arresters in general use on New England locomotives are the common bonnet sparker, the patent sparker of French and Baird, of Philadelphia, and Cutting's sparker. The bonnet sparker is the most common. A chimney of sheet iron, about 4 feet in height, is placed over the opening in the smoke-box, and a curved cast iron disc is placed immediately over the chimney.

A disadvantage attending the use of wood is the shower of sparks emitted from the chimney; indeed "sparks" is too mild a term for burning pieces of wood, which continue incandescent for a considerable period, and render it dangerous to open the windows in the carriages. From the large quantity of timber used in the construction of American railways, accidents from fire not unfrequently happen, in spite of all the precautions taken to prevent them.

The cinders and sparks projected by the blast pipes against this disc, receive from the form given to it a change in their motion, which throws them down between the bottom of the chimney and the outer casing surrounding it. The smoke and steam also receive this motion, but readily rise, and, passing around the disc, come out through a wire netting at the top. This wire-netting is to throw down such sparks as might have been carried with the steam, and would otherwise have been thrown out upon the track, becoming a source of danger to bridges and buildings along the line. A pipe sometimes leads from the bottom of the outer casing of the sparker to a spark-box on the front or sides of the smoke-box. This box, we believe, is termed the "Sub-Treasury."*

Glass gauges appear to meet with but little favour in the eyes of American engineers. "One tried on an engine on the Maine road broke in the first trial." If it only "broke," the experimenter was fortunate, for we have seen a piece of glass driven through the driver's hand, and been considerably drenched ourselves into the bargain, by one of these unlucky accidents. We are informed, on good authority, that five or six glasses have been broken on one engine in a day. All these minor grievances will now, we hope, be abolished by the introduction of the "Percussion gauge," which we are surprised to find Mr. Colburn has not alluded to. The following are the principal dimensions of five patterns of engines:—

Builders.	Boston Locomotive Works, for 6 feet gauge.	Hinkley and Drury.	Lowell Machine Shop.	Lowell Machine shop.	John Souther.
Diameters of cylinder	15 inches	$13\frac{1}{2}$ inches	$15\frac{1}{2}$ inches	14 inches	15 inches
Stroke of piston	20 ,,	20 ,,	18 ,,	18 ,,	20 ,,
Diameter of drivers	5 feet	$4\frac{1}{2}$ feet	$5\frac{1}{2}$ feet	5 feet	$5\frac{1}{2}$ feet
Diameter of inside of boilers	44 inches	37 inches	43 inches	40 inches	42 inches
Length of tubes	11 feet	$9\frac{1}{2}$ feet	11 feet	10 ,,	$10\frac{1}{2}$ feet
Number of tubes..........	141	88	140	119	135
Outside diameter of tubes..	$1\frac{3}{4}$ in.	2 inches	2 inches	2 inches	$1\frac{3}{4}$ inch.
Length of grate	36 inches	30 ,,	$31\frac{1}{2}$,,	34 ,,	37 ,,
Width of grate	40 ,,	39 ,,	$36\frac{1}{2}$,,	35 ,,	$37\frac{1}{2}$,,
Depth of fire-box	$50\frac{1}{2}$,,	36 ,,	53 ,,	$48\frac{1}{2}$,,	53 ,,
Tube surface, square feet..	710.9	437.5	806.3	623	649.42
Fire-box do. ..	56.74	39.33	56.4	52.67	60.8
Area of grate do. ..	9.74	8.12	8.	8.25	9.63
Water-room, cubic feet....	69.6	40.6	69.0	56.6	
Steam do. ..	41	32.1	41.5	33.2	
Size of steam ports	$10\frac{1}{16} \times 1\frac{5}{16}$ in.		10×1 inch.	$10 \times 1\frac{1}{4}$ in.	$9\frac{7}{8} \times 1$
Size of exhaust ports......	$10\frac{1}{16} \times 1\frac{11}{16}$ in.		$10 \times 2\frac{1}{8}$,,	$10 \times 2\frac{1}{4}$ in.	$9\frac{7}{8} \times 1\frac{1}{2}$
Position of cylinders	inside	outside	inside	inside	inside

The 15-inch cylinder machines built at Taunton have 726 square feet of tube surface, 11·23 square feet of grate, and steam ports 14 by 1 in. The performance of these engines (with blast pipes $2\frac{3}{8}$ in. at the mouth) is very superior. The Taunton Company give the largest proportion of heating surface to a given capacity of cylinder of any of the engine builders in New England.

In giving the fire-box surface, we have reckoned every inch of surface above the grate, deducting only for the tubes and the door. It is of course plain that all this surface is in contact with the water in the

* In the glossary, Mr Colburn facetiously defines this as "A receptacle for sparks, slightly different from those at the Custom-house, but quite as beneficial."

boiler, although it is customary among engineers not to include any portion of that side of the fire-box next the tubes as heating surface.

It will be seen from the table that Hinkley and Drury's 15-inch cylinder engine has the greatest extent of heating surface, compared with its capacity of cylinder, of the five engines given; and as the proportions adopted appear to answer very well, we will give the multipliers which will give the same proportions for any other size of cylinder. Multiply the square of the diameter of the cylinder by 3·159 to get the heating surface of the tubes; by ·252 to get the heating surface in the fire-box; by ·0433 to get the area of the grate; by ·309 to get the cubic feet of water room in the boiler; by ·182 to get the cubic feet of steam room in the boiler. All the engines of which proportions are given in the preceding table, have four driving wheels and truck, with the exception of the Engine by Hinkley and Drury, having $13\frac{1}{2}$ inch cylinders; this engine has four driving wheels, upon which the whole weight of the engine rests.

The heating surface of locomotive boilers has of late years been considerably increased, not only having been extended with the enlargement of the cylinders, but in a much higher ratio. In some recent 17 inch cylinder engines, constructed at Taunton, for the New York and Erie Railroad, the fire-box surface included about 90 square feet, while the tube surface fell but little short of 1000 superficial feet.

We will add a few particulars of an engine for burning bituminous coal, which was constructed for the Baltimore and Ohio Railroad, by Thacher Perkins, master of machinery on that road. The performance of this engine during the year 1849 was upwards of 23,000 miles, and was higher than that of any other first class engine on that road for the the same time.

The diameter of the cylinders was 17 inches; stroke of piston, 22 inches; four pairs of driving wheels, having chilled tires, 43 inches in diameter.

The diameter of the boiler was 44 inches, and there were 125 wrought iron tubes, 12 feet 6 inches long, and $2\frac{1}{8}$ diameter at the fire-box end, and $2\frac{3}{8}$ diameter at the smoke-box ends of same. The grate was $37\frac{1}{2}$ inches long by $41\frac{1}{2}$ inches wide, and the inside depth from crown sheet to grate was 50 inches. Attached to the boiler of this engine was the patent apparatus for heating the feed water by the surplus exhaust steam of the engine, which was invented by Mr. Perkins. The exhaust steam from both cylinders enters a square box, in the centre of the smoke box. In this box is a moveable valve by which the steam can be discharged through the ordinary blast pipes, or turned into a pipe leading to a steam casing surrounding the smoke box. This pipe also continues along beneath the boiler, and is united to a steam belt surrounding the same at the fire box end, and from which the steam finally escapes through a pipe for that purpose. The feed water can be admitted directly to the boiler, near the fire box end of this pipe, or, which is intended in running, it can be pumped into a casing surrounding this pipe, from whence it passes into a water casing surrounding the smoke box and within the steam casing already mentioned. From here it passes into the boiler a little below the water level, at the smoke box end. In this arrangement, the moveable valve in the steam box can be regulated to discharge steam enough through the blast pipes for all ordinary purposes of draught, and also to maintain a flow of steam through the pipe beneath the boiler. The feed water receives a large portion of the heat of this steam, from its contact with it in the casing surrounding the pipe; and retaining the heat so obtained, it passes into the water casing in the smoke box, where it is exposed to the heat of the waste steam on the outside, and to the temperature of the smoke box within. It thus, when finally admitted to the boiler, becomes heated quite to the boiling point, as the heat within the smoke box of a coal engine is very great, even with long tubes. This arrangement operates as a variable exhaust, by allowing any portion of the waste steam to be turned off from the blast pipes; it effects a considerable economy in fuel, by giving the water to the boiler, already heated very hot; and the water casing surrounding the smoke box prevents the destruction of the latter by the heat emitted from the tubes.

In the details of this engine, the expansion valve was worked from the backing eccentric, and one lever sufficed for reversing the engine and throwing on the cut-off. This was effected by making the cut-off rocker arm work as a shell on the main valve rocker shaft, the cambs for throwing out all the hooks being on the same camb shaft, and that for the forward hook being only a quarter camb, so as to allow that hook to be on its pin in the rocker arm in two positions of the reversing lever; that is to say, going forward with the cut-off on, and forward with it off.

Mr. Colburn appears to take for granted the suppositions as to the amount of power absorbed by the blast, and quotes " Stephenson, of Newcastle," as stating the loss at high speeds at one-half. " High speeds" is such a vague term that we do not know how to deal with it: but a reference to Mr. Clark's work (*Ante* p. 269) will at once show that in a properly proportioned engine, the loss from this source is much less than is commonly supposed.

It seems extraordinary that the value of the link motion is not sufficiently appreciated in America. Mr. Colburn says—

The valve motion generally used is the indirect attachment of the eccentric, through the rocker shaft. In ordinary inside cylinder engines, a shaft $1\frac{3}{4}$ inch in diameter is secured by stands to the cross girt supporting the slides. On this shaft there are two wrought-iron tubes or shells, one for receiving and communicating the motion for each valve. The thickness of these tubes is $\frac{3}{8}$ inch. The rocker arms which support the hooks are $6\frac{1}{2}$ inches between the centres; their hubs, $\frac{5}{8}$ to $\frac{3}{4}$ inch thick; and the arms are $\frac{3}{4}$ inch thick. The pins or bolts which support the hooks have thimbles $1\frac{1}{4}$ inch diameter and $\frac{3}{16}$ inch thick. The rocker shaft, tubes, arms, and thimbles, are all of wrought iron. In some instances, cast-iron tubes, with the arms cast therewith, have been used, and, when working on a wrought-iron shaft, have less friction than the wrought-iron tubes. The Taunton Company have used cast-iron rocker tubes on upwards of sixty engines, without breakage. The pin for the valve stem is turned with a shoulder, and is passed through the end of the upper arm, and secured by a nut on the back side of same. The thickness of the upper arm is $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, and is of the same length as the lower arm. The arms on the rocker shaft, which receive the motion of the hand hooks, are 10 inches between the centres. The object of the hand hooks is to catch the eccentric hooks when the engine is reversed, and also to assist in starting in difficult situations, as in a drift of snow. The inside of the eccentric hooks, where they wear on the thimbles of the rocker arms, is faced with a wedge or dowell of hardened steel. The eccentric rods are $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in diameter, and have right and left nuts to adjust their length. The end of the rod is secured to the brass hoop or eccentric band by bolts, or by being passed through a hub formed on same, with nuts and check nuts on each side. The eccentric band is $1\frac{1}{4}$ inches thick, and is lined with Babbitt metal. The eccentrics generally have three inches throw, and in inside cylinder engines, must be cast in two pieces to allow of their being placed between the cranks. The eccentrics are secured to the axle by set screws turned at their ends to a blunt point, and entering the axle. This is to give a chance for altering the lead of the valve when required, which could not be so readily done were the eccentrics keyed to the axle. It is for this reason also, that the eccentrics are generally cast separately, although some engines have the four eccentrics for forward and backward motion for each valve cast in one piece, or at least in two pieces, to put together around the axle. The strap under the hook is $\frac{1}{2}$ to $\frac{5}{8}$ in. thick, and long enough that the hook may traverse, when thrown out, in either direction

without striking the thimble in the rocker arms. The cambs for raising the hooks are of cast iron, and have a throw of 2 inches or more. These cambs are secured to a wrought iron shaft $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in diameter, having a pinion of 12 or 14 teeth on one end and turned by a segment, which is worked by the reversing lever on the footboard.

The expansion valve is worked through the medium of a separate rocker shaft, having also a camb shaft with reversing rod to work the same. As this camb shaft requires to be turned but one quarter around, a simple arm attached to it is all that is necessary.

The hooks are sometimes formed with V-shaped openings, in order that they may readily catch the pins when reversed.

This general arrangement of operating the valve has been recently superseded in a measure by the introduction of Stephenson's link motion, although the old establishments still adhere to the use of the rocker shaft.

The pumps of an engine are either attached directly to the crosshead, and have the same stroke as the piston, or they are worked by the same through a lever proportioned so as to give the pump plunger one-half or one-third the stroke of the piston. Many recent engines, however, including Hinkley's patterns, have an arm attached to the outside crank pin, which communicates motion to the hind pair of drivers, the end of this arm being brought up to within $3\frac{3}{4}$ inches from the centre of the wheel, and working the pump plunger, giving it a stroke of $7\frac{1}{2}$ inches. The pumps, when this connection is used, are placed at the hind end of the outside framing, and beneath the footboard. The feed water enters the boiler on the side on the fire-box, at a point about as high as the lower row of tubes. Some contend that the feed-water should be injected at the bottom of the water space about the fire-box, or at the smoke-box end of the boiler, in order that the cooling effects of the water may not act directly upon the tube sheets, and by alternately contracting and expanding them, cause the tubes to leak.

Pumps having one-half or one-third stroke are generally better for engines running quick, than full stroke pumps, as the barrel of the pump is more sure to fill while the wear of the valves is not perceptible.

The pumps on all recent engines are provided with air-vessels of iron or brass. The form of cup-valve, working in a brass cage, used by Sowther, appears to us the simplest form of valve which can be devised. It requires much less fitting than any other form of valve which we remember to have seen.

The joints between the pump and the suction and air-chambers, and the joint in the check-valve chamber, are usually ground joints of cast-iron. These, however, when long in use, frequently become leaky, as a cast-iron joint about a pump, or in any place where the water has access to it, is found not to hold its *face* well. If a composition ring be placed inside the valve chamber, to make a joint upon, the iron with which it is in contact becomes subject to a peculiar oxidation, arising from a kind of galvanic action with the composition ring. The iron about this ring often becomes *eat* full of small holes. To remedy this evil, the pumps of Souther's engines have rings of a composition *cast* inside the valve chambers, and in every situation about the pump where a ground joint is required. These rings are first cast by themselves, and their composition is so proportioned that, when placed in the mould of the valve chambers, and having the melted iron poured around them, the iron just melts the surface of the ring, and thereby becomes firmly cast with it, so that water, which is necessary for the galvanic action described, cannot enter between them. We regard this as a very excellent plan, as it saves much expense in keeping the pumps in order, and makes no material difference in the first cost of the pump.

The keys to tighten the bearings about an engine should not have too much taper, as there is danger of their becoming set so tight, as to cause the melting of the Babbitt lining of the boxes. When much tapered, they are also liable to work out, but this does not prevent them from being set so tight as to create the mischief referred to. All the bolts should be turned and fitted, and for such as pass through the straps of the connecting rods, and other parts in motion, check nuts are required. The thread of the screws should not be too coarse, as in that case the nuts are apt to work off, while if too fine, the thread is liable to strip. Threads of eleven to the inch answer very well for the medium sized bolts.

REMARKS ON THE MANAGEMENT OF ENGINES.

A well-built engine, having its parts easily accessible, and possessing good qualities for the production of steam, may, with careful management, be made to run for a long time with but little expense for repairs. The points to which the careful engineman directs his attention are the manner of firing, the supply of feed water, the proper adaptation of the production of steam to the features of the road, and various other particulars of a like nature, which are necessary for the proper performance of a locomotive. It is of course necessary to fire up oftener when the engine is performing hard work, than when the load is light. The fire should be maintained at a proper point, to make sufficient steam, and should not be suffered to get so low as to affect the pressure in the boiler. It is an object, however, in approaching a terminal station, to have barely sufficient fire to reach the engine house. The supply of feed water to the boiler is regulated very much by local circumstances on the road. In ascending grades, the injection of cold water would check the formation of steam, and it is therefore necessary to have a good supply of water in the boiler before reaching the foot of an unfavourable grade. On long levels and on descending grades, one pump may be kept working to nearly its full extent. It is seldom that both pumps require to be at work at the same time. There should also be plenty of water in the boiler before reaching either roadside or terminal stations. The fire door should be kept open as little as possible, as the entrance of the cold air through it contracts the tube sheets, and is sometimes the cause of their leaking.

If an engine has a variable exhaust, it is a good plan to open it to nearly its full extent, when firing, and to immediately contract it very much, so as to recover the fire quickly. The cylinders and valves require to be oiled at every fifteen or twenty miles of the journey. Melted tallow is used for this purpose. If the ports of the throttle valve are of the same area as the steam pipe, it is found best to keep the throttle partly closed, as when the pressure in the steam pipe is rather less than in the boilers, the engine is not so liable to prime. The proper opening for the throttle of any engine can soon be determined from observation.

In going through covered bridges and station houses, enginemen are generally cautioned to shut their dampers, and to otherwise check the draft of their engines, so as to guard against fire.

The boiler requires to be blown off at intervals of a week or more. The times at which this operation should be performed will depend very much on the purity of the water used. When a scale deposits on the tubes and on the internal shell of the boiler, a double handful of mahogany sawdust thrown in at the safety valve will tend to remove it.

There should be as few putty joints about an engine as possible; but where there are any joints requiring packing, putty seems to answer better than India rubber. It should be mixed to have a very firm and even consistency, which end is best attained by mixing the red and white lead of which it is composed, by beating with a heavy hand hammer.

The hemp for packing the piston rods, valve stems, and pump plungers, should be soaked in warm water before using. Some engineers soak it in melted tallow, but this appears to rot it. Hemp simply soaked in warm water will be found strong after two months use. Good hemp is to be preferred to India rubber for stuffing boxes.

The frequent use of the sand box on freight engines has the effect of

rapidly wearing out the tires of the wheels. Its use should, therefore, be restricted to cases where it cannot be dispensed with.

In re-painting the wood work about an engine, the best way of cleaning the work from grease and dirt is to wet it with spirits of turpentine on a handful of waste. The steam chimneys are best polished with rotten stone used with oil on a woollen cloth.

Recent Modifications of Engines.

Within a year or two, there have been constructed several engines, in various parts of the country, of novel and peculiar design. The chief feature, however, in these engines, has been an increase in the size of the driving wheels. Among these engines was one built by Edward S. Norris, of Schenectady, N.Y., for the Utica and Schenectady railroad, of the following dimensions:—

Sixteen inch cylinder, 22-inch stroke; boiler, 42 inches in diameter; 116 two-inch tubes, 16 feet 3 inches long; grate about 14 square feet; one pair of wrought-iron driving wheels behind the fire-box, and 7 feet in diameter; one pair of wrought-iron bearing wheels, just forward of the fire-box, and 4 feet in diameter; and a truck frame, beneath the smoke-box, of four 3½-feet wrought-iron wheels. The cylinders are outside, and are placed in a horizontal position, midway between the fire and smoke boxes. A large dome, at a corresponding point on the top of the boiler, supplies steam to the cylinders, through pipes running down outside the boiler to the steam-chests. The valve motion is the modified form of Stephenson's link motion, on which we have remarked on a preceding page. The frame of the engine is below the axle of the driving-wheels, and above that of the 4-feet bearing-wheels, the jaws for the bearings of the driving-axle being formed on the upper side of the frame. There is also an outside frame having a floating bearing for the end of the driving-axle; the crank and eccentrics being between this bearing and the wheel.

The performance of this engine is represented as being remarkably good.

(To be continued.)

USHER'S STEAM PLOUGH.

Mr. James Usher, of Edinburgh, has favoured us with the following description of his steam plough, which we have not ourselves seen at work, but of which a favourable account is given by those well qualified to judge. The weight of the machine is stated to be 5 tons, and the engine is of 10-horse nominal power. It has been hitherto worked with 4 ploughs, which turn over a breadth of about 3 feet, stirring the ground from 7 to 9 inches, like spade husbandry. From the size of the roller no difficulty is experienced in going over soft ground which has been once ploughed. The *Scottish Press* says—

"The cost of the machine is about £300, and is adapted to ploughing, thrashing, rolling, and harrowing. It travels 2,550 yards per hour, turning over 50 inches in breadth, which is equal to 7 acres in 10 hours, at a daily expense of 17s. or 18s., which is about 2s. 6d. per acre; while it costs 9s. or 10s. to plough an acre with horses. The actual saving to Britain, if steam is made subservient to tillage, cannot be accurately estimated. There are 47,698,000 acres of arable land in Great Britain and Ireland; and even if we do not take the difference at the rate specified above, but at the minimum saving of 4s. per acre, the saving in value will amount to £9,539,600. And although, as we have said, the first machine may not be perfect, still the fact is undeniable that the great obstacle to ploughing by steam has been got over, and with a little improvement the inventor has no doubt of making the machine perfect.

"The cost of the steam plough per day is estimated as follows:—

Coals	6s. 0d.
Engineer	3s. 6d.
2 Labourers	4s. 0d.
Horse—2 hours	1s. 6d.
Interest on machine and repairs	2s. 6d.
	17s. 6d."

The following is a description of the various details:—

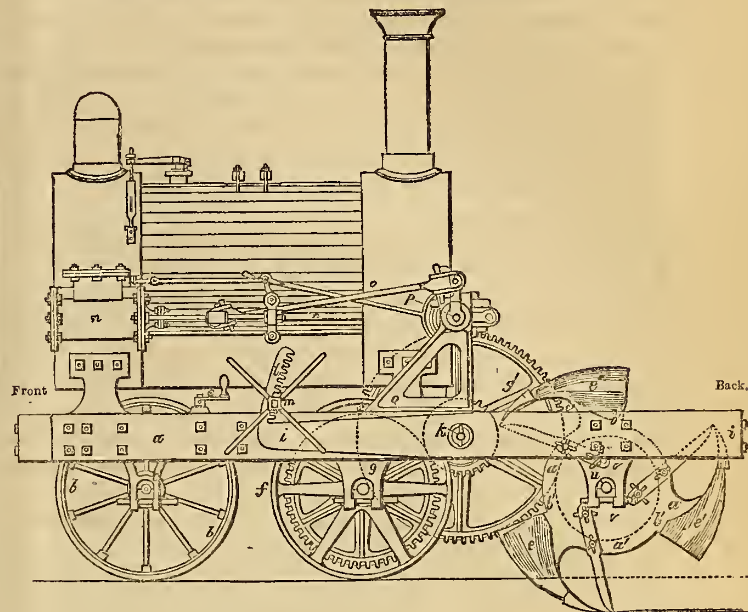


Fig. 1.

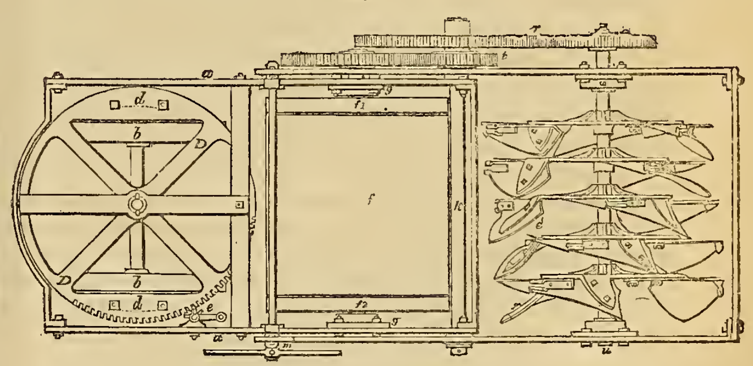


Fig. 2.

Fig. 1 shows a side elevation of steam machinery arranged suitably for carrying out this invention; fig. 2 is a plan thereof, the steam boiler and engine being removed. By referring to fig. 1 it will be seen, that the under edge of the mouldboard and share is formed to a curve struck from the centre of the shaft or axis on which the ploughs are affixed; *a a* indicate the bed-frame or carriage of the machine. The fore carriage wheels, *b b*, are mounted on an axle, which turns in bearings, *c*, attached to the swivel frame, D, which moves on the bolts, *d*, for the purpose of causing the machine to turn round in a small space. A portion of the swivel frame, D, is toothed, and acted upon by the pinion and winch, *e*; the hind part of the carriage is here shown supported upon the hollow cylinder or roller, *f*, composed of two extreme parts, f^1 and f^2, which are wheels similar to *b b*, the intermediate part, *f*, being by preference removable at pleasure, so as to render these bearing parts suitable to the different stages of cultivation to which the machine may be applied. This compound cylinder has its axle supported in the bearings, *g*, attached to the lower or to the under side of the carriage frame. The axle of this cylinder carries also at one end the wheel, *h*, to be afterwards noticed.

A moveable lever frame, *i, i, i, i*, is supported on an axle or shaft, *k*, as a fulcrum. The free ends, *i' i'*, are formed into the toothed segments, *l*, and are concentric to *k*, these segments being acted upon by the two toothed pinions and spindles, *m*, which elevates or depresses the hind part, *i i*, of the lever frame, and all that it carries, at the pleasure of the conductor.

On the carriage thus constructed is placed the locomotive boiler, with its engines of any ordinary construction, as *n n*, the power of which is applied through the medium of connecting rods, *o*, to the crank shaft, *p*, the two arms of which stand at right angles to each other, in the usual way. The crank shaft, *p*, is supported on two standards, *q*, securely fixed to the carriage. On the shaft, *p*, there is also fixed the spur pinion, indicated by the dotted circle, *p' p'*, in fig. 1; and this pinion, by taking into the wheel, *r*, mounted on the shaft, *k*, gives motion at the same time to the pinion, *t*, which is carried round on the same shaft, *k*. The pinion, *t*, thus actuated, takes into the wheel, *h*, before referred to, on the bearing cylinder, *f*; and it is preferred that the pinion, *t*, should be applied so as readily to be put into and out of gear with its wheel, though not so shown in the engraving. By this arrangement of parts, a slow progressive motion is obtained for the whole machine, on the one hand through the cylinder, *f*, and on the other hand a separate rotary motion, at a certain increase of speed, is communicated through the wheel, *r*, to the pinion, *w*, fixed upon the shaft, *u u*, which last-named shaft has its bearings, *v v*, attached to the moveable frame, *i i*.

On the shaft, *u u*, are placed a series of plates of plates or projections, fixed at regular distances. Or such plates or projections, with their ploughs afterwards described, may be placed upon separate shafts, each with its own proper gearing; but it is preferred to place them on one shaft. These plates or projections on the axis are shaped in such manner as to receive and have affixed to each of them several ploughs, adapted by their revolving motion to penetrate the soil, and by their mouldboards to elevate and turn over portions thereof; *a a* are the plates or projections fixed upon the shaft *u*; they are each formed with a strong boss at the centre, by which it may be securely fixed to the shaft. Each plate, *a'*, has three arms or prolongations, *b b b*, which terminate in the radial direction shown; a further prolongation, *d' d'*, is carried obliquely upon each of these arms. Upon the plate and projections thus constructed is affixed the tilling apparatus, which consists, firstly, of the part *e'*, which acts the part of the mouldboard or turn-furrow in the common plough; and it is to be fixed by screw bolts, or otherwise, to the prolongation, *d' d'*. To the fore part of this mouldboard, *e e*, is affixed a bar of wrought iron, which is also furnished with a lug by which it is attached to the plate, by means of screw bolts or otherwise; the bar, thus secured, forms a head or share-bearer, as in many common ploughs. To the fore part of the bar the share is adapted, and fixed by its socket. The mouldboard, and also the share, may be varied in form. A fore-cutter or coulter is affixed in front of each share, by screw bolts or otherwise, and is provided with the means of adjustment, through the counter slits in itself and in the plate; but in order to meet the different qualities of soils, and the various stages of tillage, further provisions may be employed. The number of plates or projections, and also the number of ploughs in each, may be varied.

It will be seen that not only the ploughs which are set in the same plane around the axis follow each other into action, but that the ploughs of the other sets (which are affixed around the axis in parallel planes), are arranged and come into action, so that two ploughshares will not strike the earth at the same instant. In the arrangement of the apparatus before described, it will be seen that the propelling of the machine along the land is by reason of the resistance of the land to the ploughs as they enter and travel through the earth, and the motion communicated to the wheels or rollers. This part of the invention is applicable where teeth or tines suitable for tilling the earth are applied about an axis, and will be found to act better than machines in which tines or teeth set around an axis, have had motion communicated to them from the wheels which run on the land. In thus using this part of the invention, the only change necessary will be to employ a rotary axis, *u*, having tines or teeth of any suitable shape, in place of the ploughs shown in the engravings.

AGRICULTURAL ENGINEERING.

REPORT TO THE BOARD OF HEALTH ON LISCARD FARM, NEAR BIRKENHEAD.

BY W. LEE, ESQ., SUPERINTENDING INSPECTOR.

This farm is situated about four miles westward of Birkenhead, in the county of Chester, and contains, altogether about 450 acres, 350 of which which belong to Harold Littledale, Esq., the occupier, and the remainder, rented by him, consists of low poor land of comparatively little value.

The geological stratum is the lower new red sandstone, with a combination of diluvial drift, and the alluvium of the estuary of the Mersey.

Mr. Littledale has drained all the land capable of being drained. Both pipes and tiles have been used. Some of the drains are laid only $2\frac{1}{2}$ feet deep, others 4 feet, and latterly, the depth has been 5 feet. The depth has been increased as the result of experience. The widths apart vary from 6 to 9 yards. The average would be about 7 yards. The cost was £4 to £5 per acre.

The arrangements for collecting and applying liquid manure are similar to those in Ayrshire, and Mr. Young, the engine-maker of Ayr, has been employed in the construction of the works.

The tank is 60 feet long, 12 feet wide, and 13 feet deep, furnished with lever agitators, similar to those at Myer Mill farm. The capacity of the tank is equal to 58,300 gallons, and the cost about £200.

The steam engine is of 10 horse power high pressure. The cylinder is 10 inches diameter, with a 30 inch stroke. At the time of my visit it was working 43 strokes per minute, with a pressure of 28 lbs on the square inch. At full speed it works 60 strokes per minute. The original cost was £80; but it has been improved and altered so that its present value may be stated at £150. As in the other instances brought before you, this engine chops, grinds, crushes, steams, thrashes, churns, pumps water, and does all the farming work capable of being performed by machinery, in addition to the pumping and forcing of liquid manure.

Mr. Littledale's bailiff, Mr. Teasdale, said, that the engine cannot perform all these operations at the same time; but that the irrigation, when it is going on, scarcely requires four horse power. As to the time occupied for this part of its work, I was informed that a blacksmith does all the shoeing, repairing, and ironwork of the farm, besides attending to the engine. The latter does not take up one third of his time, as the engine only works two days in the week. It was also said that one day per week would be a liberal allowance for manuring. The wages paid to this man are 26*s*. per week and four tenths of one day would give 1*s*. 9*d*. as the weekly sum due to the irrigation. The distribution is conducted by a man and a boy, whose united wages are 20*s*. weekly. One day to the irrigation will be 3*s*. 4*d*. per week.

The engine, when working, consumes 10 cwt. of coals per day of ten hours, at a cost of 8*s*. per ton. The proportionate sum per week, therefore, due to the irrigation works for coals, is 1*s*. 8*d*.

There are two pumps, each $4\frac{1}{2}$ inches diameter, with 24-inch stroke, and working 25 strokes per minute. At this rate of working, they are capable of raising 41,154 gallons per day of ten hours. The cost of the pumps would be about £70. The liquid manure is conveyed by iron pipes 3 inches diameter, and the present extent is about 2 miles, serving for 150 acres. The pipes have been brought from Scotland, and the cost including laying is 1*s*. $9\frac{1}{2}$*d*. per yard. There is a hydrant for every 300 yards of main, and the cost of each is 18*s*. The hydrants are so fixed that with 150 yards of hose the distributor and boy can irrigate 10 acres per day. This being an acre per hour, a reference to the quantity pumped will give 4,115 gallons per acre for each application.

The hose pipe is of gutta percha, and consists of 75 yards, 2 inches dia-

meter, costing 2*s.* 6*d.* per yard, and 75 yards 1½ inch diameter, costing 2*s.* per yard.

The liquid manure is now sent out to a distance of half a mile, and the jet from a circular orifice of an inch in the discharge pipe will rise nearly 30 yards high, and falls like a shower at a distance of 25 yards from the distributor. Mr. Littledale intends to have another tank of the same size as the one already constructed, so as always to have plenty of liquid manure in spring.

Following the course I have pursued throughout these investigations, I now proceed to draw out Mr. Littledale's capital account for the irrigation.

Tank	£200	0	0
Proportion of steam engine	60	0	0
Two pumps...	70	0	0
Iron pipes	315	6	4
Hydrants	9	18	0
75 yards of 2-inch gutta percha hose	9	7	6
75 yards of 1½ inch ditto	7	10	0
	£672	1	10

From the data already ascertained, the following will be the annual account for interest and working expenses:—

Interest upon £672, and wear and tear, at 7½ per cent.	£50	8	0
Fuel due to irrigation	4	6	8
Wages	13	4	4
	£67	19	0

Divided by 150, the number of acres irrigated, the amount is equal to an average of 9*s.* 0¾*d.* per acre.

This mode of fertilizing has not been long in operation at Liscard farm, but liquid manures have been for a considerable time applied there by the more expensive and clumsy method of carting on the land. Like the Duke of Sutherland's, therefore, this farm is in a transition state, and I would not claim for the specific mode of application a degree of fertility that is primarily due to the nature of the fluid laid on.

The liquid manure used being the same, however, in both methods of application, it is fair to conclude that an equal quantity laid on evenly, without poaching the land, would be, at least, as productive as if distributed from a cart.

The cost of the various modes of applying manures may be considered distinctly from the productive results; and the works being already in operation in this instance, I am able to state the outlay and working expenses as accurately as if the economy had been tested by the experience of years instead of months.

It is exceedingly interesting to review occasionally the progress made in matters of public and national importance, and, after looking back at the original views of the promulgators of new doctrines in social economy, to see how far those views have proved correct, or have become modified by experience. About ten years ago, Mr. Chadwick, recommending the collection of all fertilizing matters in tanks, wrote—

"The mode of emptying by a pump and hose, whatever may be the distance acquired for the conveyance of the manure, will be found to be much cheaper than the water cart. With the hose, the refuse may be got on to gardens, lawns, and places where the cart cannot go, and may be got at all times. With the force-pump, it may be carried to all heights under 120 or 130 feet, and the hose may extend to half a mile or three quarters of a mile, or more. Within such lifts as seven or eight feet, and over all descents, the labour of pumping which would be required to get the liquid manure into a water cart would, with the hose, convey it to a considerable distance."

According to the estimates already given, the expense in fuel and labour for the distribution of 4,115 gallons of liquid manure by the hose and jet, would be 8*d.* The quantity is equal to 20 loads, and the distribution by a water cart, including the pumping from the tank, carrrying half a mile, and laying on, would cost 8*d.* for a load, or 13*s.* 4*d.* for 4,115 gallons.

I have stated elsewhere that the liquid manure produced a crop of Swede turnips equal to that produced by 25 to 30 tons of solid manure, which cost about £2 10*s.* for application. I need not therefore waste time by any further remarks on the comparative economy of laying on liquid *versus* solid. The facts are self-evident. Mr. Littledale has had the farm about eleven years, and has erected all the present buildings, including a lodge, a house for the bailiff, and eight cottages for the labourers.

A million of bricks were made out of two old marl pits close by, and the excavation was then converted into a water reservoir for the whole establishment. All the spouts of the buildings run into it. The water is pumped by the engine into a raised cistern of wrought iron, holding 10,000 gallons, and thence distributed by taps. The bailiff says the water is good and abundant, and now that they have got a large manure tank, they intend to apply water to the solid manure to liquify it.

The present live stock yielding manure consists of 81 milk cows, 2 bulls, nearly 100 pigs, and 12 horses. All the liquid from the stables, cow-houses, piggeries, yards, cottages, and the bailiff's house, drains underground to the tank.

As the general result of drainage, liquid manures, and other improvements effected by Mr. Littledale, I was informed that the yield of the whole farm is double what it was 10 years ago.

The liquid manure has been hitherto applied to nothing but grass. It is intended now, however, to apply it to other crops.

My informant said—

"We have now 80 acres of Italian rye grass, and look to it first for food for the cows. We buy nothing for the cattle but malt grains, the annual account for which is about £130. We sell a portion of the turnips at times, but shall have none to spare this year. We also sell some potatoes and straw, but generally the crops are consumed on the farm."

The Italian rye grass has had none but liquid manure, and has been cut three or four times during the summer and autumn. The crops averaged from 2½ feet to 3 feet thick each cutting. The fourth crop from one piece was weighed, and produced 10 tons per acre.

That was the least of the crops from the same land, but the whole produce of that piece was above the average.

Many calves are sold, but the value of the young stock is low in the market, and I could not ascertain the sum realised.

From 50 to 60 pigs are killed per annum. Some few are sold as pork, but the greater part is made into bacon. The average weight is about 20 stones each, and the bacon sells wholesale at 7*d.*, and the hams at 9*d.* per pound.

Two hundred gallons of milk per day, on the average, are sold to New Brighton and Seacombe, at 1*s.* per gallon.

The butter averages 180 lbs. per week, at 1*s.* 2*d.* per pound.

Taking the bacon and hams at 7½*d.* per lb., on the average, the annual produce of the farm in these three items alone is as follows :—

	£	*s.*	*d.*
Bacon	481	5	0
Milk	3,650	0	0
Butter	546	0	0
	£4,677	5	0

The farms occupied by Mr. Littledale and Mr. Neilson are ten miles from each other, in a district very favourable for agricultural improvements, and within accessible distance from an immense population.

It might reasonably have been expected, therefore, that these examples would have induced a spirit of emulation throughout the district, and that steam engines and liquid manure tanks, &c., would have been almost as numerous as farms.

I made enquiry and found, that although the modes of farming have improved within the last ten years, there is still very little of what is called high farming in the neighbourhood. The farms in general are small, and few are disposed to copy the examples set before them by Mr. Littledale and Mr. Neilson. I could only hear of one steam engine, five miles distant from Mr. Littledale's farm, used for any agricultural purpose.

ON VENTILATION BY THE PARLOUR FIRE.

By William Hosking, Esq.

Professor of Architecture and of Engineering Construction, at King's College, London.

(Concluded from page 89.)

The mode thus indicated of increasing the effect of the familiar fire, and making it subservient to the important function of free and wholesome ventilation, is not to be taken as a mere suggestion, and now for the first time made. It has been in effective operation for six or seven years, and is found to answer well with the simple appliances referred to. But it is the mode and the principle of action that it is desired to recommend, and not the appliances, since persons more skilled in mechanical contrivances than the author professes to be, may probably be able to devise others better adapted to the purpose.*

The mode referred to of warming and ventilating apartments by their own fires is most easy of application, and in houses of all kinds, great and small, old and new, and as the warmth derived from the fire in any case comes directly by the in-drafted air, as well as by radiation of heat into the air of the apartment, fuel is economized. If the register flap be made to open and shut, by any means which give easy command over it, so that it may be opened more or less according to the occasion, and this be attended to, the economy will be assured; for it is quite unnecessary to leave the same space open over the fire after the steam and smoke arising from fresh fuel have been thrown off, as may be necessary immediately after coaling. The opening by the register valve into the flue may be reduced when the smoke has been thrown off, so as to check the draft of air through the fire, and greatly to increase the draft by the upper opening into the flue, to the advantage of the ventilation and to the saving of fuel, while the heat from the incandescent fuel will be thereby rather increased than diminished.

Moreover, the system being applicable in the cottage of the labourer, as fully and easily as in the better appointed dwellings of those who need not economize so closely as labouring people are obliged to economize, the warmed air about the grate in a lower room may be conveyed directly from the air-chamber about the grate by a metal or pot pipe, up the chimney flue, and be delivered in any upper room next to the same flue and requiring warmth and ventilation, the process of ventilation applied to the lower room being applicable to the upper room also.

The indicated means by which winter ventilation is obtained are not of course equally efficient in summer, for the draft of the fire is wanting; but the inlet at the low level for fresh air, and the outlet for the spent air at the upper level continuing always open, the heat which the flue will in most cases retain through the summer, aided by that of the sun's rays upon the chimney top, secures a certain amount of up-draft, which is not without its effect upon the in-draft by the lower inlet, even when windows and doors are shut.

While it is obvious that the air drawn into any house for the purpose of in-door ventilation need not be other than that which would enter by the windows of the same house, it may be necessary to enter into an inquiry as to the condition of the air heretofore spoken of as fresh and pure. "Fresh" and "pure" applied to air must be taken to mean the freshest and purest immediately obtainable, and that will be the same whether it be drawn in through a grated hole in a wall, or by a glazed opening closed by it in the same wall. But it is a fair subject for inquiry, whether—speaking in London to Londoners—the air about our houses in London is as pure—or as free from impurity—as it might be.

The out-door ventilation of large towns may be taken to be more complete above the tops of the houses and of their chimneys than it is, or, perhaps, can be among and about the houses. The processes of nature are there not only unchecked, but are in fact aided by the heat thrown up by the chimneys into the upper air, and impurities which can be passed off by chimney flues, will be more certainly and more effectually removed and changed by Nature's chemistry, than if they are kept down to fester under foot and to exhale in our streets and about our doors and windows.

At this time every endeavour is made to provide for removing from our dwellings all excrementitious matter, and all soluble refuse, by drains into sewers, and so by the sewers to some outfall for discharge. The drain necessarily falls towards the sewer, and the sewer again to its outfall, and the sullage or soil drainage being rendered liquid thus passes in the usual course. But the usages and the necessities of civilized life cause a large proportion of the liquid refuse from dwelling-houses to pass off in a heated state, or to be followed by hot water arising from culinary processes, and from washing in all its varieties. The heat so entering the drains causes the evolution of fetid and noxious gases from the matters which go with, or have gone before, the hot water; and with these gases house-drains almost always, and sewers commonly, stand charged. They are light fluids, and do not go down with the heavy liquid matters from which they have been evolved, but they seek to rise, and constantly do rise in almost every house through imperfections or derangements of the flaps and traps which are intended to keep them down, but which only, when they do act, compel some of the foul air to enter the sewers, and there to seek outlet to the upper air, which they find by the gulley gratings in the streets.

It can hardly be said, perhaps, that *too much* attention has been given of late to the scour of sewers by water; but it is most certain that too little attention has been given to the consideration last stated, for nothing has been done to relieve the drains and sewers of their worst offence. The evolution of foul and noxious gases in the *drains* is certainly not prevented by scouring the *sewers*. In the meantime the poison exists under foot, and exudes at every pregnable point within and about our houses, and it rises at every grating in our streets, though the senses may become dull to them by constant suffering.

Now, this is an evil which can be greatly ameliorated, if it cannot indeed be wholly cured; but it is by a process that, to be effective, must be general, and, therefore, it must be added, compulsory. The process is of familiar application in the ventilation of mines, and particularly of coal mines. An up-cast shaft containing a common chimney-flue carried up at the back of every house, and connected with the house-drains at their highest level, would give vent to the foul air in the drains, and discharge it into the upper air. The foul air evolved by heat expands, and expanding it rises, and rising it would be followed by cold air settling down by the gulley gratings in the streets, thus constituting their inlets downcast shafts, and the sewers and drains themselves channels for the currents setting to the up-cast shafts, by which they would be relieved. The down draft into the sewers would carry with it much soot and fine dust, which would settle upon the liquid current and pass off with it, and so remove some of the tangible as well as the intangible impurities before referred to, from the air in our streets and about our houses.

Much in this way might be effected by the aid of causes in constant operation; but if the upcast shaft to every house were also a fire-flue, or were only aided by the draft of a neighbouring fire, the up-current would be sufficient not only to prevent the house drains from retaining foul air, but the foul air would be thrown off into the upper air with better effect, and be dissipated innocuously and without offence, instead of steaming as it now does from the sewers into the air where it cannot be avoided.

* The appliances used by Mr. Hosking will be found more fully described in his "Healthy Homes," published by Mr. Murray.

REPORT ON SCREW STEAM BOATS, EMPLOYED ON THE GRAND CANAL.

By Sir John Macneill, C.E., F.R.S., &c. &c.

(Concluded from p. 25.)

No. 2 boat was built at the Ringsend Works, and the engines and machinery were made and put into her by Mr. Inshaw, of Birmingham, who has constructed several steamboats used on English canals. The length of this boat is 60 feet, and its width 12 feet. The boiler is 4 feet 6 inches in diameter, containing 48 tubes of $2\frac{1}{2}$ inches diameter, and 6 feet long; the cylinders are 7 inches in diameter; length of stroke 18 inches, and calculated to make 120 strokes per minute, the pressure being 50lbs. The boat is propelled by two screws, 4 feet pitch, 3 feet in diameter, and 2 feet long, placed at each side of the stern-post, worked with bevelled gear and two-fold multiplying power. This principle of construction appears to answer very much better than that of No. 2 Boat with one screw, for it is capable of being stopped, and the

motion reversed, with much greater ease than the other, and it steers stern foremost almost as well as when running forward, which is a most important and essential requisite in any steam-boat employed in canal traffic, where obstacles and interruptions are so frequent, and which might be attended with danger, if the power of reversing was not easy and effective; in this respect it is very superior to the boat with one screw, which does not steer at all when the motion is reversed, but runs direct across to one side or other, according to the position of the boat at the moment of reversing. This boat (No. 2), was engaged by the builders to carry 40 tons gross, to be furnished with engines of 12-horse power (nominal), consisting of two oscillating cylinders, and a tubular boiler, with feed-pipes and reversing gear, and capable of going with that load at about 5 to 6 miles per hour, and of propelling itself and another boat at the rate of about 3 Irish miles, or $3\frac{3}{4}$ English miles per hour. This agreement does not, however state what load the boat to be propelled or towed was to carry, but it would appear to be the same as in the steam-boat, that is, 40 tons gross. By the experiments made with this boat, it is evident that she falls very much short of this performance, for with 41 tons she went only at the rate of $3\frac{1}{2}$ miles per hour, instead of 5 to 6 miles; and when towing a boat loaded with 52 tons, she went at a rate of only $2\frac{1}{4}$ miles per hour, instead of $3\frac{3}{4}$. In fact, when loaded with 20 tons only, she went at the rate of 4 miles only per hour; this discrepancy would appear to arise from want of power in the engines, for it does not appear that they are more than 8-horse power, instead of 12; it may, however, be possible, that other circumstances, connected with the form or arrangement of the screw, may be the cause of the want of speed, but want of power in the engine is the most apparent defect. Before, however, drawing any conclusion from the experiments referred to, it will be proper to describe them. The first set of these experiments was made on the 24th April; the weather was cold, but there was little or no wind to affect the free movement of the boats.

First Experiment, 24th April, 1851, was made with steam-boat No. 2, loaded with 41 tons. The distance of half-a-mile (measured), was run in 8′ 25″, being at the rate of 3·56 miles per hour. During this experiment, the pressure on the boiler was 50lbs., and the average number of strokes was 102.

Second Experiment.—In this experiment, the boat was loaded with 41 tons as before, and a barge was attached to it by a tow rope. This barge was loaded with 52 tons; the pressure was 42lbs., and the average number of strokes per minute was 87. The same distance as before was run in 13′ 6″, or at the rate of 2·29 miles per hour.

Third Experiment.—In this experiment two barges were attached to the steam-boat; one was loaded with 53 tons, the other with 30 tons, besides the 41 tons in the steam-boat, in all 124 tons. The pressure on the boiler was 50lbs., as in the first experiment; and the average number of strokes of the piston was 98, whilst the time occupied in passing over the same space was 14′ 40″, or at the rate of 2·05 miles per hour.

On the 26th April the following experiments were made with the same boat:—

First Experiment.—The boat was loaded with 20 tons, the pressure was 50lbs. on the safety-valve, the average number of strokes was 100 per minute, and the same distance of half-a-mile was run in 7′ 30″, or at the rate of 4·0 miles per hour.

Second Experiment.—In this experiment one barge, loaded with 50 tons, was attached to the steam boat loaded with 20 tons; the pressure as before was 50lbs, and the average number of strokes per minute was $90\frac{1}{2}$, whilst the same space ran over required 12′ 20″, or at the rate of 2·43 miles per hour.

Third Experiment.—In this experiment two boats loaded with 50 tons each were attached to the steam boat loaded with 20 tons, in all 120 tons of goods; the pressure was 50lbs., the average number of strokes was 94, and the space was passed over in 12′ 55″, which was at the rate of 2·31 miles per hour.

On the 5th of May the following experiments were made with No. 1 steam boat, having two screw propellers.—

First Experiment.—The boat was loaded with 20 tons of goods; the same half mile distance was run over as in the former experiments with No. 2 boat; the pressure was 45 lbs., the number of strokes averaged 110 per minute; the distance was run in 6′ 41″, which was at the rate of 4·49 miles per hour.

Second Experiment.—In this experiment a barge carrying 50 tons was attached to the steam boat, which was loaded with 20 tons; the pressure was 49 lbs. as before; the average number of strokes per minute was 101, and the time was 9′ 12″, which was at the rate of 3·26 miles per hour.

Third Experiment.—In this experiment three boats were attached to the steam boat—one was loaded with 50 tons, the second with 27 tons, and the third with 34 tons, in all 131 tons, including the 20 tons in the steam boat; the pressure was 49 lbs,, the average number of strokes per minute was 96, and the time occupied was 10′ 58″, which was at the rate of 2.73 miles per hour.

One fact, but certainly a most important one, has been established by these experiments, and that is, that a very much greater and more useful effect is produced by *hauling* than by *carrying*. This fact was exemplified by every experiment that was made, though it was more apparent in one of the boats than the other, as will be seen by reference to the experiments; it also appears that one form of boat and machinery is less affected in speed than the other by a proportional increase of weight hauled than carried; from this it is evident, that the form of boat and machinery most suitable for carrying goods will differ from the form of boat and machinery suitable for haulage. The barges and boats on your canal are much too large, heavy and unwieldly; they are a heavy load in themselves, and require considerable power to move them, even at a slow rate, when empty; they are also formed as if they were to be employed as sailing barges, similar to those on the Thames and other rivers: this is a very great mistake, and quite unsuited to canal navigation. If the boats were built 60 feet long, 6 feet 6 inches wide, with upright sides, and upright cornered bows, which would admit two of them to enter a lock at the same time, a great amount of saving would be effected on your canal in the power required to haul such boats, as compared with those now in use, for I have no doubt that six of those boats carrying 35 tons each, would be as easily hauled as two of the present boats, 50 tons each—or in the ratio of 210 to 100—and that such a steam boat as No. 1, at present in use, would be enabled to haul these six boats carrying 210 tons of goods at the rate of three miles an hour, and carry at the same time 20 tons of goods, besides the 210 tons hauled. I would, therefore, strongly recommend you to have two such boats built, and if you found that the saving in power required for hauling was what I have stated, it would be judicious to have all new boats built on the same plan. I am well aware that it is very difficult to get parties long accustomed to a particular form of boat or carriage to adopt a different one; but I am convinced the advantages of the light and narrow boat would be so apparent, that it would in a short time be universally used in canals in this country, as such boats are at present used in most of the canals in England and Scotland; and in any future engines that may be ordered for your canal, I would recommend that the fire-box should be made as large as the construction of the boat will admit of, and that the draught up the flue be as moderate as possible, as more suitable to a turf fire than one of coke, for there cannot be a doubt but turf or peat fuel will answer every purpose of working steam boats on the canal, and will be very much cheaper than either coal or coke. My replies to the queries put to me will form the subject of a further report, which shall be submitted with as little delay as in my power.

(Signed) JOHN MACNEILL.

Mount Pleasant, Dundalk, 21*st July*, 1852.

NOTES BY A PRACTICAL CHEMIST.

Remarks on Drinkable Waters.—1. The physical and chemical constitution of these waters varies continually.

2. When the temperature is highest, the density of the water is also most considerable.

3. The water of the ocean contains chloride of lithium and .0092 gramme of iodide of sodium per quart; but no trace of nitrates, although these salts are poured abundantly into the sea by the currents of fresh water flowing into it. The cause of this singular phenomenon is due to two reactions:—1st, by the reductive action of sulphuretted hydrogen, excreted by various mollusca, the nitric acid of these salts is transformed into ammonia and water; 2nd, under the influence of the respiration of fish a similar phenomenon is manifested, yielding likewise an ammoniacal product. The ammonia thus formed is eliminated again from the water as ammonio-phosphate of magnesia, found in the mud of seas and rivers.

4. Rain and snow-waters generally contain traces of all the mineralizing agents of sea-water. The former retain always some traces of sulphuretted hydrogen.

5. The waters of the ante-diluvian soils generally contain lithia and phosphates, as well as fluorides, from the decomposition of mica.

6. Waters from lime soils contain traces of ferruginous matter, often accompanied with carbonate of magnesia.

8. Iodine and bromine are found, except under some peculiar circumstances, *in all natural waters*. We can easily recognize their presence even in rain and snow-water.

9. These two bodies may be withdrawn from water by the action of vegetables.

10. Endemic goitre and cretinism are due not to the use of calcareous, magnesian, or selenious water, but to the more or less complete absence of these elements, withdrawn from the waters by the plants whose roots they have bathed. These diseases do not appear as endemics save in countries whose drinkable waters wash a great number of plants.

11. In cities, the watering of streets during times of choleraic epidemics should be prohibited.

Decolorizing Power of the Charcoal and other Bodies.—M. Filhol has shown that charcoal is not the only elementary body possessing the property of decolorizing liquids; sulphur, arsenic, and iron, as reduced from the hydrated peroxide by hydrogen, possess this property. The number of compound bodies endowed with an appreciable decolorizing power is much greater than has been supposed, and depends much more on the state of division of these bodies than on their chemical qualities. A certain body which easily appropriates one colouring matter may have very little tendency to remove another; thus, bone, phosphate of lime (artificially obtained), with difficulty decolours sulphindigotate of soda, whilst it acts on tincture of litmus more energetically than animal black. The decoloration is, in the majority of cases, a purely physical phenomenon. Thus, the same colouring matter is absorbed by metalloids, metals, acids, bases, salts, and organic substances; besides, it is easy, by means of suitable solvents, to procure the colour unaltered from the body by which they have been absorbed.

Magnesia as Antidote to Copper.—Calcined magnesia completely arrests the symptoms of poisoning by sulphate of copper when administered sufficiently early. The dose required is at least 8 parts of the antidote to 1 of the sulphate. As the magnesia behaves towards other salts of copper as it does to the sulphate, it is very probable that it will serve as an antidote to all the salts of copper.

ANSWERS TO CORRESPONDENTS.

"Z. A. Bolton." It is not our opinion that the fibre of cotton undergoes any *chemical* alteration in Mercer's process. If such were the case, although it might render some colours more brilliant, how could it act favourably upon all? Many practical men of our acquaintance suppose that the cotton fibre is merely split up into fine filaments by the action of the soda, and by thus reflecting light from a greater number of points, it gives increased lustre to any superinduced colour. Our correspondent is of course aware that if a piece of cotton velvet and one of calico are passed through the same vats, the former, from the different mechanical state of its fibre, will appear far more brilliant.

"Mr. J. Edwards." Your sample has not been received.

CORRESPONDENCE.

ON THE LOSS OF THE BIRKENHEAD.

To the Editor of the Artizan.

Sir—I beg to hand you extracts from my letters to the Admiralty, which will, I think, require no comment on my part.

To Sir Francis Baring, on sending the 'Birkenhead' to sea with troops in her dangerous state, April 21st, 1851.

"Every disinterested person acquainted with the merits of the subject, must be aware that the slightest accident is liable to send the *Birkenhead* to the bottom with all on board at the shortest notice, and that the water-tight compartments with which she is fitted, will afford but a slender chance of keeping her from foundering in the ocean before it be possible to take effectual steps to save the crew and troops from the fate to which you have thought proper to expose them; and, as I observed but a few weeks since, you only can be considered responsible for the ill fated catastrophe, should it unfortunately occur."

I objected to iron ships in their present unfinished state the moment I inspected the first ship, and considered they would not be made safe without an impervious ceiling; but the Admiralty refused to attend to me. After this the bulkhead system was introduced, but I could not admit that it was a sufficient protection, and experience fully bears me out in that opinion; still, up to this moment, iron ship builders continue to act upon it.

My patent embraces the building of iron ships in various ways, to add security and strength, and I feel assured will not add much, if any, to the present expense.

I propose to ceil them throughout, or in part, and to make the engine room of steamers a perfect safety chamber without reducing its capacity. I have also safety holds or cabins, which it will be impossible for the water to break into; of sufficient capacity to keep the vessel afloat, should all the other parts of her get filled with water; and should the vessel break to pieces, these safety holds or cabins are so constructed that they will separate from the vessel without danger, and form a complete vessel for the crew to take shelter in. They are light, buoyant and strong, and will add strength to the whole fabric, and be perfectly capable of carrying all that is necessary in the event of danger; and should the vessel wreck on rocks, they will carry the crew, by their buoyancy and strength, nearer the shore to escape. I beg again to observe the expense of those fittings will not amount to any thing great; and such vessels so fitted, may be insured at a less rate than other vessels, which will more than compensate for the original building.

I am, Sir, your obedient Servant,

JOHN POAD DRAKE.

St. Austell, April, 1852.

METALLIC PACKING.

To the Editor of the Artizan.

Sir,—Seeing in your last number a plate and description of a metallic packing, patented in this country by C. W. Copeland, of the United States' navy, I enclose a lithograph of a metallic packing invented by me in 1848, and now in extensive use. I have varied the design according to circumstances. In some instances the matrix or conical piece forms the bush.

In the "Albion," locomotive engine, it was $\frac{1}{4}$ inch less than the inside of the gland, as shown, "for the purpose of allowing the packing to move to suit any irregularity in the parallel motion." In others, the cone and rings were inverted, the former being bored out of the gland, and the latter resting upon the bush. The rings were in some cases cut square across, in others diagonally, and always placed to break joint.

I have tried numerous compositions of metals for packing rings, and find pure tin the best.

I do not often protrude myself before the public, and therefore I cannot let this opportunity pass without recording that the volute springs, as patented by Baillie, and the conical springs, patented by Brown, were both invented by me in 1845, or 1846, and applied as engine-buffers, and are no doubt still in existence as such.

Trusting you will give this letter and sketch in your next publication,

I am Sir, yours, &c.
THOS. HUNT.

London and North Western Railway,
Preston, April 8th, 1852.

[We have not engraved the diagram of the packing which Mr. Hunt has forwarded to us, for the simple reason that it is exactly similar in principle to Mr. Copeland's. The present is another example, in addition to those which we every day experience, of the way in which inventors sacrifice their own interests and those of the mechanical world at large, by not publishing their plans as soon as matured. We have no doubt that there are some hundreds of our readers in a similar predicament, and yet who will not muster up sufficient courage to put pen to paper.—ED.]

PRESERVATION OF THE CRYSTAL PALACE.

MY DEAR SIR,—As one of the objections to the permanent establishment of the Crystal Palace, as a place of refined amusement, recreation, and intellectual culture to all classes, is the great cost of maintaining it, I beg to give you somewhat more in detail and with slight additions, the items of an estimated annual revenue which I addressed to you as long ago as last July, when I formed those opinions which I have since had the pleasure of participating with you of the great public utility to which this splendid creation of yours might be devoted.

Assuming that the general arrangements of the interior would be a large conservatory, with walks, fountains, plants, and shrubs that would live in a low temperature, collections of mineralogy, botany, geology, architectural models, designs of various kinds to interest and instruct all classes of visitors; to which might be added schools of design, lecture rooms, collections of inventions and mechanical improvements by ingenious artizans—I am of opinion that the following schedule represents by no means an exaggerated estimate of the sum which might be derived from the CyrstalPalace annually:—

ESTIMATE OF REVENUE.

	£	s.	d
If the outer division of the parallelogram was devoted to equestrians, having a light railing dividing it from the rest of the building, I propose that all parties having the privilege of riding there, should pay one guinea annually, and that there may be 800 subscribers	840	0	0
All persons desirous of having the entrée to the rest of the building every day in the year (Sunday included) should have tickets of admission at £1 1*s*. A register to be kept of their names and residences; and the General Board of Management to determine as to their eligibility. I expect from this source 10,000 subscribers, representing ..	10,500	0	0
Note.—Viewing the success of the Horticultural, Botanical, and Zoological Societies, where to become a member, it is necessary to be proposed, seconded, balloted for, and pay a large entrance fee, I think the foregoing item (divested of those formalities) is not over estimated.			
I propose that Monday and Tuesday in each week be devoted to the working classes, who shall visit the whole of the building on payment of 3*d*. each. I estimate 5,000 daily	6,500	0	0
Wednesday and Thursday should be devoted to visitors at 6*d*. each. I estimate on each of these days 5,000 ..	13,000	0	0
Friday 1*s*., say 5,000	13,000	0	0
Saturday 2*s*. 6*d*. each, on which day there might be musical entertainments, or other attractions calculated for the upper classes, 5,000 each day	32,500	0	0
	76,340	0	0
Other sources of profit might be made available from the privilege of selling refreshments, say annually	1,000	0	0
For placing statuary or works of art, 1,000 objects at 1*s*. each per week	2,600	0	0
	£79,940	0	0

The foregoing estimate may be considered rough and inaccurate, but it may lead to the question being minutely investigated, and brought to practical working, if we are fortunate enough to preserve the building from the destruction that awaits it.

I remain, my dear Sir, yours very truly,
BENJAMIN OLIVEIRA.

SIR JOSEPH PAXTON.
London, 5*th April,* 1852, 8, *Upper Hyde Park-street.*

THE STEAM FRIGATE BIRKENHEAD.—IRON *VERSUS* WOOD.

(From the *Liverpool Albion.*)

THE Birkenhead was constructed (under the immediate inspection of Mr. G. D. Banes, of Chatham Dockyard) of great strength in thickness of plates and size of frames, &c., as the following statement of the comparative weight of the hulls of several large steam frigates conclusively shows, oak and teak-built vessels, such as those the comparison is made with, being generally much heavier than iron vessels :—

NAME.	Builder.	Iron or Wood.	Tonnage, O. Rule.	Weight of Hull when launched.
Birkenhead... ...	Laird	Iron	1,400	903 tons.
Megæra	Fairbairn ...	Iron	1,395	743 „
Vulcan	Mare	Iron	1,764	1,000 „
Terrible	Dockyard ...	Wood	1,850	1,130 „
Sampson	Ditto	Wood	1,299	730 „
Retribution	Ditto	Wood	1,641	1,217 „
Mozuffer	E. India Co.	Wood	1,440	991 „

The Birkenhead was completed and fitted with engines of 564 horse power by Messrs. G. Forrester and Co., and left this port in 1846, and on her passage to Plymouth was reported by the officer in charge to have made 12 to 13 knots on her passage round. She was at this time in fair trim, not being fitted with the heavy poop and forecastle afterwards added to increase her accommodation as a troopship. For some time she was laid up, but eventually commissioned by Captain Ingram, and employed in various ways on the coasts of England, Ireland, and Scotland, and towed the Great Britain from Dundrum Bay to Liverpool. Her next employment was carrying troops to the Channel Islands, Lisbon, &c., which services she was considered to have performed very satisfactorily, making some remarkably quick runs. She was commissioned in 1850 by Commander Salmond, and has since been to Halifax, Cape of Good Hope, &c.; her last run from Halifax to Woolwich was made in $13\frac{1}{2}$ days, with a large number of troops on board, and, by a judicious arrangement of only working one boiler and the engines expansively, Captain Salmond was enabled to steam long distances with a very small expenditure of fuel.

Her speed may be best tested by her passage to the Cape last year, with troops, as contrasted with other vessels in the navy sent on similar service:—

Birkenhead	45 days.
Vulcan	56 „
Retribution	65 „
Sidon..	64 „
Cyclops	59 „

And her return home in October was made in 37 days, including stoppages.

Her last passage out occupied 47 days, having left last January, during very bad weather. The Megæra, that sailed about the same time, had been 54 days out, and had not arrived when the last Cape mail left.

On the whole, her performances prove her to have been the fastest, most carrying, and comfortable vessel in Her Majesty's service as a troop-ship, and one that could be fully relied on, both in hull and machinery. The Admiralty appear to have taken every precaution to keep her in efficient condition, as she was docked on her return from the Cape in October, 1851, and her hull examined and reported in perfect order; her machinery was improved with a view of economizing fuel; and, on her trial at Spithead, after this refit, she made, with 400 tons of coal, 60 tons of water, and four months' stores on board, fully 10 knots per hour.

All accounts from the survivors of the Birkenhead's melancholy loss agree in one respect, that the cause of the accident was striking upon a sharp-pointed rock, going at a speed through the water of eight and a half knots; and when we consider that her weight or displacement at her load draught, as a troop-ship, was upwards of 2,000 tons, the effect of such a blow may be readily imagined. The Birkenhead was divided into eight water-tight compartments, by athwartship bulkheads; and the engine-room was subdivided by two longitudinal bulkheads into four additional compartments, forming the coal-bunkers; making in all 12 water-tight sections.

The first blow (from the description of Captain Wright and other survivors) evidently ripped open the compartment between the engine-room and fore-peak, and to such an extent that the water instantaneously filled it, as stated by the engineer, Mr. Renwick; and the next blow stove in the bilge of the vessel in the engine-room, thus filling the two largest compartments in the vessel in four or five minutes after she struck. Had she been a wooden vessel, or not built in compartments, she must have gone down, like Her Majesty's steam-frigate Avenger, in five minutes after she first struck. As it was, the buoyancy of the after compartment alone was the means of giving time to get the boats out and saving most of those who were rescued from death.

Eventually the long swell, and at least 1,000 tons weight of machinery, coals, &c., amidships, acting against the buoyancy of the after division, caused her to break off as described, and sink in deep water. The case appears to be parallel with the Orion's, the sides and bilge having in both instances been ripped open in the forward and engine-room compartment.

The case of the Nemesis striking on the rocks off St. Ives, 10 or 12 years ago, was somewhat similar, excepting that she ran stem on, and consequently only damaged her fore-foot, and admitted the water into her foremost small compartments.

Many other accidents have happened, proving the vast superiority of iron vessels in cases of grounding, and, in proof of this we may, in conclusion, quote the evidence given by Mr. A. F. B. Creuze, Chief-Surveyor of Lloyd's, before the Committee on Army and Navy Estimates of 1848:—

"Are there any points in which, in your opinion, iron has an advantage over wood as a material for building ships?—It has, from the before-mentioned reasoning, the advantage of greater lightness combined with the same quantity of strength, or more strength combined with equal lightness; you may consequently build a better formed ship of iron; you may take advantage of its comparative lightness to build a ship of a better form. The expense of the repair of iron is exceedingly trifling compared with the expense of the repair of wood, and the facilities for repair extraordinary. There are two or three remarkable instances of this on record. There is the Nemesis, one of the vessels of which I spoke, which went out to China. When she was passing round the Cape she encountered a gale of wind, and she literally split down; she was run on shore and repaired by her crew in a very short space of time, and went to sea again, and they went with her direct to the China war. The Phlegethon ran on a rock; she knocked a hole in her bottom that was 12 feet in length. I saw a letter from the commander to say he could walk in and out of it. In 10 days she was repaired and fit for all purposes by the crew alone. That would have been perfectly impossible with a timber-built ship. The Nemesis ran upon a rock off the Scilly Islands in going from Liverpool to Odessa; she put into Portsmouth; she had knocked a hole in her stem; she was repaired at an expense of £30, though Mr. Laird had to send for the workmen from Liverpool to do so.

"If a wooden vessel had struck in the same way, do you think she would have gone down?—Decidedly so."

Details of the Birkenhead, as given by Mr. Laird, will be found in the *Artizan* for 1849, p. 103.

J. AND R. WHITE'S IMPROVEMENTS IN SHIP BUILDING.

Messrs. J. and R. White, the eminent ship builders, of Medina docks, Cowes, have lately obtained a patent for an improvement in the build of vessels, on what is familiarly called the "bread-and-butter system," that is, where the frame timbers are dispensed with, and the planking laid diagonally in three thicknesses. Some of our finest vessels, such as the *Banshee*, by Oliver Lang, are built on this plan. Some difficulty, however, is experienced, from the necessity, in the ordinary arrangement, shown in fig. 1, of bending the planks under

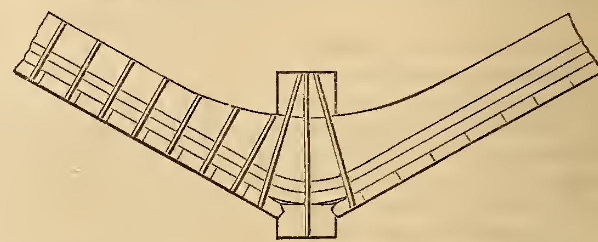


Fig. 1.

the floor timbers, at the stem and stern of the vessel, where the floor rises and the angle is more acute. Messrs. White propose to overcome this by not carrying the planking round the vessel, but by rabbetting the ends into the keel, as shown in fig 2. It will be understood that

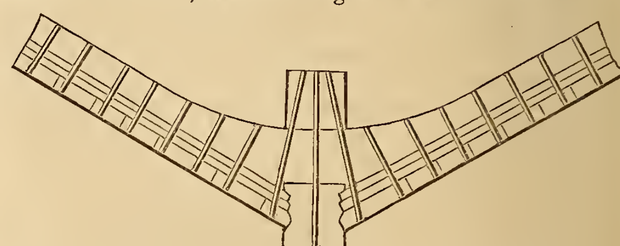


Fig. 2.

the two inner thicknesses of plank are crossed diagonally, and the outer one laid longitudinally.

An important addition to the strength of the vessel is gained by the arrangement of keel in fig. 2, by its being so much deeper, and being better secured; whereas in fig. 1 it is merely a shallow piece, unsupported, and liable to be carried away.

The advantages of the "bread-and-butter system" ("Sandwich system," we would suggest as a better title) are—that greater internal capacity is obtained, by 10 to 20 per cent., with, of course, greater buoyancy, greater strength from the more perfect combination of the materials, and greater durability and facility of repair.

NOTES ON RECENT ENGLISH PATENTS.

Timothy Kenrick, of Edgbaston, near Birmingham, ironfounder, *for improvements in the manufacture of wrought-iron tubes.* Sept. 4, 1851.

These improvements consist in glazing wrought-iron pipes, for which two compositions are used. The body is composed of calcined flints, borax, and potter's clay, ground up with water, which is applied in a liquid state to the whole of the interior of the tube. A surface glaze or enamel is then applied, in the form of powder, and the tube exposed to heat sufficient to vitrify the glaze. Cast-iron pipes having been already glazed, the patentee only claims its application to wrought iron.

Gail Borden, of Texas, *for improvements in the treatment of certain animal and vegetable substances, to render them more convenient for use as articles of food, and for their better preservation.* Sept. 5, 1851.

The patentee's process is to extract all the nutriment in the meat by boiling, and then to evaporate it to the consistence of treacle, in which state it is mixed with flour or powdered biscuit, into a dough, which undergoes the usual processes of biscuit making and baking. The biscuits are to be kept in air-tight cases, and, when used, only require boiling in hot water, with the addition of salt, &c.

Baron Wedderstedt, *for improvements in preserving animal and vegetable substances.* Sept. 4, 1851.

In this case, the inventor desiccates the meat only, by cutting it, freed from bone and fat, into small pieces, and exposing it, mixed with flour, to a temperature rising from 70° to 120°. When dry, the meat is to be packed in air-tight cases.

Canvass and similar fabrics are proposed to be preserved from decay, by rubbing into them a mixture of lime and resin in hot water. The canvass is also to be treated with a mixture of sperm and linseed oil.

RECENT AMERICAN PATENTS.

For an *improvement in ships' winches;* Thomas G. Boone, Brooklyn, New York, October 21.

"The nature of my invention consists in the investing of the power of the lowering motion of one load or burden, so as to make it aid in the hoisting of another; thereby greatly facilitating the loading and unloading of shipping, making the labour easier and the despatch greater."

Claim,—"Having described my invention, its mode of construction and operation, I do not claim the rigging of a winch or windlass with counter-falls, for the hoisting and lowering of burdens on the counterpoise principle, at whatever relative distance of hoisting and lowering it may be fixed, simply as such.

"But I claim the combination, in a ship's winch, of the principle of adjustability with the principle of counterpoise, whereby I am enabled to vary the relative distances of the hoisting to that of the lowering motion, so as to adapt its action to various changes of the relative distances of the hoisting to that of the lowering, as required in the lading and unlading of vessels.

"I claim also therewith, the principle of using a hoisting in connexion with a lowering fall, so that the burden is hoisted by one fall, and lowered by the other, instead of interchanging the falls; so that each load or parcel is both raised and lowered by the same fall, as has been practised in other counterpoise machines, by which means my winch is more convenient to use than it would otherwise be, when the hoisting and lowering distances are dissimilar.

"2nd, I claim a fall, or chain and hook, suspended over the deck or scaffold, working as a suspension chain and medium of transfer from the hoisting to the lowering fall of a ship's winch, whereby I am enabled, as described, to transfer packages or burdens, in sling, from the hoisting to the lowering fall, without re-slinging or otherwise resting them."

For an *improvement in pianoforte strings;* Henry J. Newton, City of New York, October 21.

"My invention consists simply in coating the smaller strings of pianos with silver, in any of the usual ways, for the purpose of improving the tone, at the same time protecting them from the rusting action of the atmosphere."

Claim.—"I do not claim as my invention simply the application of silver to the strings of pianos, for the purpose stated, as that has before been done by wrapping the strings with silver wire; but when wrapped with wire, are liable to rattle when struck with the hammers; but what I do claim as my invention is, coating the smaller strings of pianos with silver, or an alloy thereof, for the purpose of improving the tone, and preventing the rusting of the strings, substantially as specified."

STEAM MARINE OF THE UNITED STATES.*

At the last session of Congress, the Senate, by resolution, directed the Secretary of the Treasury to collect and report statistics, exhibiting officially the external and internal Steam marine of the United States. William D. Galiagher, Esq., was commissioned to obtain the inland, and Professor E. D. Mansfield the external; and most faithfully and ably have they discharged the arduous duty. The aggregate results far exceed, in magnitude and importance, the most extravagant estimates and anticipations. These reliable facts and statistics were reported to the Senate on Thursday last, by the Secretary of the Treasury. We take the subjoined statements from that report:—

The steam marine of the United States, on the Atlantic and Pacific coasts and the Gulf of Mexico, is as follows:—

From Passamaquoddy Bay to Cape Sable, there are 46 ocean steamers; 274 ordinary steamers; 65 propellers, and 80 ferry boats. Tonnage, 154,270 tons. High pressure steamers, 116; low pressure, 342. Number of officers and crews, 8,348. Passengers annually, 33,114,782. Average miles travelled, 8,118,989. These statistics refer to the year ending July 1, 1851.

The steam marine on the Gulf of Mexico, from Cape Sable to the Rio Grande, consists of 12 ocean steamers; 95 ordinary steamers; 2 propellers. Tonnage, 23,244. High pressure, 97; low pressure, 10. Number of officers and crews, 3,473. Passengers during the year, 148,700. Number of miles travelled, 1,360,380.

The steam marine on the Pacific coast consists of 37 ocean steamers; 13 ordinary steamers. Tonnage, 34,986. High pressure, 3; low pressure, 47. Officers and crews, 1,949. Average miles travelled, 79,209.

The aggregates of the external steam marine are—

Ocean steamers, 96; ordinary steamers, 382; propellers, 67; ferry boats, 80. Total, 625. Total tonnage, 212,500. High pressure, 213; low pressure, 412. Officers and crews, 11,770. Annual passengers, 33,342,846. Of the annual passengers, 24,009,550 were by ferry boats.

The shipwrecks in the United States, on the Atlantic and Pacific coasts and Gulf of Mexico, during the year ending July 1, 1851, were 50 ships, 59 brigs, 190 schooners, 9 sloops, and 20 steamers. Total, 328; of which 278 were by tempest, 14 by fire, 15 by collision, 19 by snags, and 2 by explosion. The number of lives lost was 318.

The "human movement" by steamboat, on the principal tide water lines was as follows:—

	No. of Passengers.
On long Island Sound	302,397
On Hudson river	995,100
Between New York and Philadelphia by steamers .	840,000
On Potomac and James rivers and Chesapeake Bay	422,100
Gulf of Mexico	169,508
Pacific coast	79,209

In 26 districts on the Atlantic coast, there were 160 vessels lost, valued at 1,559,171 dollars, and on which insurance was paid to the amount of 968,350 dollars.

In New York, the marine insurance paid was ..	3,520,161 dol.
In Philadelphia	906,616 „
In Boston	554,865 „

The total marine (not inland) insurance paid during the year is estimated at 6,227,000 dollars.

The inland steam marine of the United States comprises three grand divisions—the northern frontier, the Ohio basin, and the Mississippi valley:—

	Steamers.	Tonnage.	Officers & Crew.	Passengers.
The northern frontier has	164	69,165	2,855	1,513,390
The Ohio basin	348	67,601	8,338	3,464,967
The Mississippi valley ..	255	67,957	6,414	882,593
Total	765	204,723	17,607	5,860,950

Of the passengers, 2,481,916 were by ferry boats, and in addition to the above, there were 1,325,911 passengers by railroads, 86,000 by canals, and 27,872 by stages, on the northern frontier line of travel, and 265,936 railroad and 28,773 stage passengers on the Ohio basin line.

Travel to and from Inland Commercial Centres.

Pittsburgh (last year)	466,856
St. Louis	367,795
Buffalo	622,423
Chicago	199,883
Total..	1,656,957

* From the *New York Tribune*, January 26, 1852.

The resident population of these four cities is but 217,966.

The travel to and from Buffalo "comes and goes" as follows:—

By ordinary steamers	157,257
Propellers	14,300
Ferry boats	26,280
Buffalo and Rochester railroad	262,386
Niagara railroad	119,200
Erie canal	43,000
Total	622,423

St. Louis has 131 steamers; New Orleans, 109; Detroit, 47; Buffalo, 42; Pittsburgh, 12. During eight years ending July 1, 1851, the tonnage in the Buffalo district has increased 19,217 tons; in Presque Isle, 2,778; Cuyahoga, 4,563; and in Detroit, 14,416. The steamboat tonnage of the Upper Lakes has more than quadrupled in eight years, and on the Mississippi valley it has doubled in nine years.

The steamboat disasters on the Mississippi and tributaries since the introduction of steam to the year 1848, are, by collision, 45; fire, 104; snags, 469; total, 618. The original cost of the boats, 9,899,748 dollars; deficiency in value, 5,176,757 dollars; final losses, 4,719,991 dollars. The loss in 1849 is stated at 2,000,000 dollars.

Losses on the lakes and rivers during the year ending July 1, 1851, by tempest, 35; fire, 30; collision, 18; snags, 32. Persons lost on the lakes, 87, and on the rivers, 628; total, 695.

The average tonnage of lake steamers is 437 tons; of the Ohio basin, 206; and of the Mississippi valley, 273.

Of the 558 ordinary steamers on the rivers, 317 are enrolled in the districts of the Ohio basin, and 241 in those of the Mississippi valley.

Of the 147 ordinary steamers and propellers on the lakes, 31 are enrolled on the Lakes Champlain and Ontario and the St. Lawrence, 66 on Lake Erie, and 60 at Detroit and the lakes above.

Of the 164 steam vessels on the lakes, 105 are ordinary steamers, 52 are propellers, and 43 are ferry boats.

Of the 601 steam vessels on the rivers, 558 are ordinary, and 43 are ferry boats.

With but two very slight exceptions, there is an uninterrupted line of steam navigation from the waters of the Gulf of St. Lawrence to those of the Gulf of Mexico— a distance of about 28,000 miles, and upon which is employed, for the purposes of trade and travel, a steam tonnage of 60,166 tons. The Ohio basin forms, of itself, a cross section of about 1,100 miles in length.

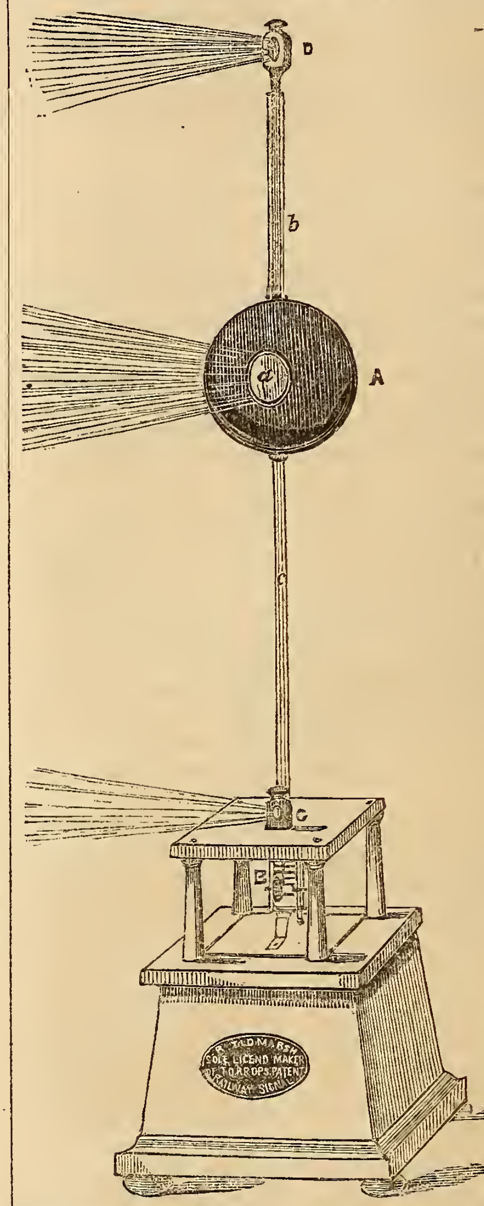
The steam marine of Great Britain and her dependencies is stated to consist of 1,184 boats, with 142,080 tonnage; while the inland steam marine of the United States consists of 766 boats, with a tonnage of 204,613 tons; showing that, exclusive of the steam tonnage of [the Atlantic and Pacific seaboard and the Gulf coast, the inland steam tonnage exceeds that of Great Great Britain and her dependencies by 62,533 tons.

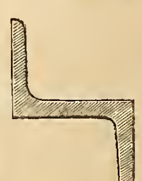
ENGLISH AND AMERICAN PROPELLERS FOR ATLANTIC NAVIGATION.

The success attending the *City of Glasgow* and *Manchester*, running to this port, and the *Glasgow* to New York, all English vessels, has led many, myself among the number, to be very much surprised at the partial failure, at least, of the *S. S. Lewis*, running to Boston, the *Pioneer*, to New York, and the *City of Pittsburgh*, to this port. And it has occurred to me that the great height of our American propellers above the water, and the consequent instability caused thereby, together with their very heavy rig, will account for the whole difference; for example, the *City of Manchester* is 274 feet long, 37¾ feet beam, and 31 feet hold, with an average draft of water of about 18 feet; while the *City of Pittsburgh* is 24 feet long, 38 feet beam, and 33 feet hold, with heavy houses on deck in addition, and to this must be added about 1½ feet as the difference of thickness of the bottom between wood and iron; her average draft is 20 feet; it is very evident from this, that the section of the *Pittsburgh* above and below water is the greatest, which, combined with her heavy rig, must, during the prevalence of strong westerly winds of winter, give the latter a decided advantage. The English custom, looking at the points and dimensions of their propeller ships, is to make them as low as is consistent with comfort and safety, and to obtain capacity by length. Which is right? Will some one answer?—*Franklin Institute.*

NOVELTIES.

Torrop's Patent Railway Signal.—The importance of a perfect system of signals for railway purposes can hardly be over-estimated, and we are inclined to think that railway managers are not sufficiently impressed with this truth. As a contribution towards a more systematic code of signals, Mr. Torrop's is worthy of attention. The signal consists of a pole, 16 feet high, on which slides a copper ball, 18 inches diameter. This is wound up to the top as soon as a train has passed; and as it takes 10 minutes, or any other given time, to descend, the driver of the following train is notified whether within that time a train has preceded him. A is the copper ball, containing a lamp, *a*; C and D are similar lamps to mark the top and bottom of the pole. B is the machinery by which the ball is wound up, the strings passing up each side of the pole, as at *b*, and descending through it, as at *c*. A signal of this kind would be extremely useful to notify the departure of trains, steam boats, &c., to show the passengers hurrying to the station how long they had to spare. And it would be better than a clock, because it would be visible in all directions at a greater distance, and could leave no doubt as to the exact minute at which the train started. This apparatus can be inspected at Mr. Tidmarsh's City Exhibition, in Basinghall Street.





Water Space Angle Iron.—Messrs. Sutton and Ash, iron merchants, of Birmingham, have registered an improved form of angle-iron, for the bottoms of water-spaces in firebox boilers, of which we have given a section. An advantage of this form is, that the outside rivetting is conveniently accomplished, more room is given for deposit of mud, &c., and a smooth surface is obtained, which can be readily scraped clean through the mud-holes.

Austin's "British Bond."—Under this title, Mr. W. Austin, the architect, has registered a novel form, having for its object the better bonding together of the work. Fig. 1 is a plan of paving, or a solid pier, formed of these bricks, showing their dovetailed form; which obviously gives them a very strong hold of each other. Fig. 2 is a plan of a $1\frac{1}{2}$ brick wall, a portion of which may be left hollow, if desired, or may be filled in with bricks of a corresponding shape. Fig. 3 is a 1 brick wall. Fig. 4 is a single brick of the form required for stretchers, tbe splayed form of which serves well for the outer reveals of doors and windows. Bricks of extra length, are made so as to form a 1-brick hollow wall, with spaces for vertical iron pipes, through which hot-air can be passed, for warming conservatories, picture-galleries, and other buildings, where open fires are objectionable. Now that the abolition of the brick excise has set so many ingenious heads to work, we ought to have the benefit of it in all our newly-built dwellings.

Fig. 1.

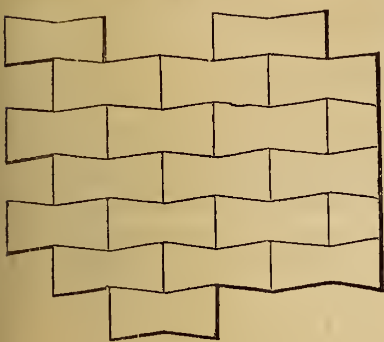
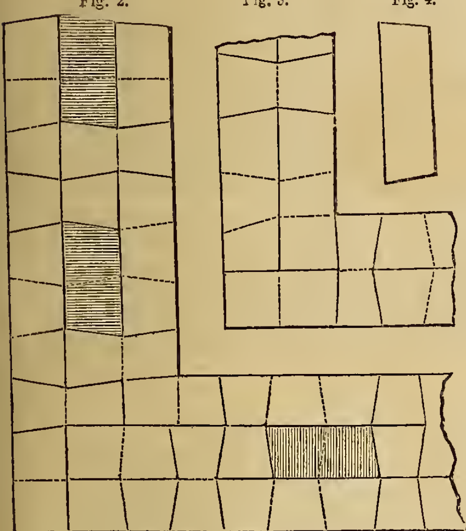
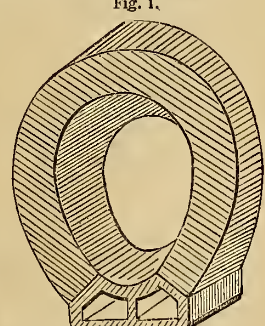


Fig. 2. Fig. 3. Fig. 4.



Invert Block for Sewers.—Messrs. H. Doulton and Co., of the Potteries, Lambeth, have recently registered an improvement in tbe construction of sewers which will materially increase their stability and efficiency. For information on this subject, we may refer the reader to p. 29, vol. 1846, where examples of the failure of various forms from being crushed in are given. The egg shaped sewer, with the small end downwards, is unquestionably the most efficacious, in facilitating the scouring effect of tbe water, *vide* p. 279, vol. 1848. The stability of the egg, however, has been a problem hitberto only to be solved by a Columbus breaking the point. Messrs. Doulton and Co., in a more business-like manner, have provided tbe egg with a flat base, which not only provides an excellent foundation for the sewer, but also saves a great deal of time and trouble in turning the sharp invert, which oannot be effectually done except with guaged bricks. Fig. 1, is a transverse section of a sewer, built in this manner with tbe earthenware base, which is perfectly impermeable to water, and it is hollowed out to save weight. Fig. 2, is a plan of the base, the ends of which, it will be perceived, are formed to dovetail into each other, and so bind the whole sewer together, and enable it to resist any side pressure to which it may be subjected.

Fig. 1.



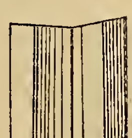


Fig. 2.

LIST OF ENGLISH PATENTS.

From 20th March, to 22nd April, 1852.

Six months allowed for enrolment, unless otherwise expressed.

William Froggatt, of Manchester, house and decorative painter, for a certain improvement or improvements in the process of decorative painting, which improvement or improvements are applicable to rooms, halls, carriages, furniture, and other purposes to which decorative painting has or may be applied. March 20.

John M'Dowall, of Walkinshaw Foundry, Johnstone, Renfrew, North Britain, engineer, for improvements in cutting wood and other substances, and in the machinery or apparatus employed therein, and in the application of power to the same, parts of which improvements are applicable for the transmission of power generally. March 20.

William Westley Richards, of Birmingham, gun-manufacturer, for certain improvements in fire-arms, and in the means used for discharging the same, also improvements in projectiles. March 20.

William Symington, of Trafalgar-place, West, Hackney-road, Middlesex, gentleman, Charles Finlayson, of Manchester, engineer, and John Reid, of the same place, gentleman, for improvements in flues, and in heating air, and in evaporating certain fluids by heated air. March 22.

John Drumgoole Brady, of Cambridge-terrace, Middlesex, Esq., for improvements in helmets, cartridge-boxes, and other military accoutrements. March 22.

Edward Morewood and George Rogers, both of Enfield, Middlesex, gentlemen, for improvements in shaping, coating, and applying sheet metal to building purposes. March 24.

John Macintosh, of Berners-street, Middlesex, civil engineer, for improvements in ordnance and fire-arms, and in balls and shells. March 24.

Antoine Maurice Tardy de Montravel, of Paris, France, gent., for certain improvements in obtaining motive power, and the machinery employed therein. March 24.

Isaac Brookes, of Birmingham, manufacturer, and William Lutwyche Jones, of Birmingham, aforesaid, manufacturer, for certain improvements in stoves, and other apparatus for heating. March 24.

William Whitaker Collins, of Buckingham-street, Adelphi, civil engineer, for certain improvements in the manufacture of steel. March 24.

William Cole, of Birkenhead, Chester, architect, and Alfred Holt, of Liverpool, Lancaster, civil engineer, for an improved method of preventing and removing the deposit of sand, mud, or silt, in tidal rivers in certain cases, and also in harbours, docks, basins, guts, or other channels, communicating with the sea through tidal rivers, or otherwise, the same being applicable in certain cases to other rivers or moving waters. March 24.

John White and Robert White, of Cowes, in the Isle of Wight, ship builders, for improvements in ship building. March 24.

William Henry Hulseberg, of Mile-end, Middlesex, for certain improvements in the treatment of wool, hair, feathers, fur, and other fibrous substances, and in machinery or apparatus for the same. March 24.

William Archer, of Hampton-Court, Middlesex, gent., for an improved mode, or modes of preventing accidents on railways. March 24.

Thomas Bell, of Don Alkali Works, South Shields, for improvements in the manufacture of sulphuric acid. March 24.

Richard Parris, of Long-acre, Middlesex, modeller, for improvements in machinery or apparatus for cutting and shaping cork. March 24.

William Pidding, of the Strand, gentleman, for improvements in the construction of vehicles used on railways, or on ordinary roads. March 24.

Edward Hammond Bentall, of Heybridge, Essex, ironfounder, for improvements in the construction of ploughs. March 25.

John Smith, of Bilston, Stafford, brassfounder, for certain improvements in locomotive and other steam engines. March 25.

Jean Jacques Bourcart, of the firm of Nicholas Schlumberger and Company, of Guebwiller, France, for improvements in preparing, combing, and spinning wool and other fibrous materials. (Being a communication.) March 27.

William Thompson, of Salford, Lancaster, machine-maker, and John Hewitt, of Salford, aforesaid, machine-maker, for improvements in machinery for spinning, doubling, and twisting cotton and other fibrous substances. March 27.

James Melville, of Roebank Works, Lochwinnoch, Renfrew, North Britain, calico printer, for improvements in weaving and printing shawls and other fabrics. March 29.

James Timmins Chance, of Handsworth, Stafford, glass manufacturer, for improvements in the manufacture of glass. (Being a communication.) March 29.

Charles Jack, of Tottenham-court, New-road, for improvements in machinery for grinding pigments, colours, and other matters. March 29.

John Whitehead, of Holbeck, York, machine-manufacturer, for improvements in machinery for preparing, combing, and drawing wool, silk, and other fibrous substances. March 29.

John Flack Winslow, of the City of Troy, in the State of New York, in the United States of America, iron-master, for improvements in machinery for blooming iron. March 31.

Moses Poole, of the Patent Bill-office, London, gentleman, for improvements in fire-arms (Being a communication.) March 31.

William Earnshaw Cooper, of Mottram, Chester, tallow-chandler, for certain improvements in the manufacture of candles and candle-wicks, and in the machinery or apparatus employed therein. April 2.

Joseph Pimlott Oates, of Lichfield, Stafford, surgeon, for certain improvements in machinery for manufacturing bricks, tiles, quarries, drain-pipes, and such other articles as are, or may be made of clay or other plastic substances. April 6.

Samuel Fox, of Stocks Bridge-works, Deepear, near Sheffield, for improvements in umbrellas and parasols. April 6.

William Watson Pattinson, of Felling-new-House, Gateshead, manufacturing chemist, for improvements in the manufacture of chlorine. April 6.

Moses Poole, of the Patent Bill-office, London, gentleman, for improvements in covering wires for telegraphic purposes. (A communication.) April 6.

John Walter De Longueville Giffard, of Serle-street, Lincoln's-inn, Barrister-at-law, for improvements in fire-arms and projectiles. April 6.

Charles William Siemens, of Birmingham, engineer, for an improved fluid meter. (Being a communication.) April 15.

François Joseph Beltzung, of Paris, in the Republic of France, engineer, for improvements in the manufacture of bottles and jars of glass, clay, gutta percha, or other plastic material, and caps and stoppers for the same, and in machinery for pressing and moulding the said materials. April 15.

Edwin Pettit, of Kingsland, Middlesex, civil engineer, and James Forsyth, of Caldbeck, Cumberland, spinner, for improvements in machinery for twisting, drawing, doubling, and spinning of cotton, wool, silk, flax, and other fibrous substances. April 15.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements for preventing the incrustation of steam boilers, which invention is also applicable to the preservation of metals and wood. (Being a communication.) April 15.

Charles Seeley, of the City of Lincoln, for improvements in the manufacture of flour. April 15.

Thomas Ellwood Horton, of Priors-lee-Hall, Salop, iron-master, and Elisha Wylde, of Birmingham, engineer, for improvements in apparatus for heating and evaporating. April 15.

Simon Davey, of Rouen, France, merchant, and Adolphe Ludovic Chann, of Paris, France, merchant, for improvements in explosive compounds and fusees, and also in methods of firing the same. April 15.

Henri Gustave Delvigne, of Brixton, Surrey, gentleman, for certain improvements in fire-arms, and in the methods of discharging the same; also improvements in projectiles. April 17.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for cutting paper, pasteboard, or other similar substances. (Being a communication.) April 17.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in the method of and apparatus for indicating and regulating the heat and the height and supply of water in steam boilers, which said improvements are applicable to other purposes, such as indicating and regulating the heat of buildings, furnaces, stoves, fire-places, kilns, and ovens, and indicating the height and regulating the supply of water in other boilers and vessels. April 17.

John Gillett, of Brails, near Shipston-on-Stour, Warwick, agricultural implement-maker, for certain improvements in ploughs. April 17.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of lenses. April 17.

William Henry Dupre and Clement Le Sueur, of Jersey, for improvements in certain apparatus or apparatuses for preventing smoky chimneys, applicable to other purposes of ventilation. April 17.

Clemenz Augustus Kurtz, of Manchester, manufacturing chemist, for an improvement in all preparations of every description of madder roots and ground madder, in or from whatever country the same are produced; also of munjeet in the root and stem, from whatever country. April 17.

Henry Stothert, of Bath, engineer, for improvements in the manufacture of manure. (Being a communication.) April 17.

William Hyatt, of Old street-road, Middlesex, engineer, for improvements in obtaining and applying motive power. April 17

John Knowles, of Little Bolton, Lancaster, cotton spinner, for improvements in certain machinery for preparing cotton and other fibrous substances, for reversing the direction of motion in, and for regulating the speed of machines. April 17.

John Trotman, of Dursley, Gloucestershire, for improvements in anchors. April 20.

Robert Griffiths, of Clifton, engineer, for apparatus for improving and restoring human hair. April 20.

Robert Reyburn, of Greenock, chemist, for improvements in printing on silk and other fabrics and yarns. April 20.

William Maddick, of Manchester, manufacturing chemist, for the production of a liquid extract from madder and its preparations, suitable for the purposes of dyeing or printing and a new treatment of spent madder, garancine, or garancaux, or other preparations of madder, to render them available for the like purposes. April 20.

John Ridgway, of Cauldon-place, Stafford, china manufacturer, for certain improvements in the method or process of ornamenting or decorating articles of glass, china, earthenware, and other ceramic manufactures. April 20.

William Hindman, of Manchester, gentleman, and John Warhurst, of Newton-heath, near Manchester, cotton dealer, for certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith. April 22.

Edward Hammond Bentall, of Heybridge, Essex, ironfounder, and James Howard, of Bedford, ironfounder, for improvements in the mode of chilling cast iron. April 22.

James Stevens, of Birmingham, glass manufacturer, for certain improvements in lamp glasses. April 22.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the method of manufacturing, and in machinery to be used in the manufacture of wood screws, part of which improvements is applicable to the arranging and feeding of pins and other like articles, and also improvements in assorting screws, pins, and other articles of various sizes. (Being a communication.) April 22.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the mode of priming fire-arms. (Being a communication.) April 22.

LIST OF SCOTCH PATENTS.

From 22nd of February, to the 22nd of March, 1852.

William Hamer, of Manchester, Lancaster, for certain improvements in looms for weaving. February 23.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finshury, London, for certain improvements in gas burners. (Communication.) February 26. Four months.

Charles John Mare, of Blackwall, for improvements in constructing iron ships or vessels, and steam hoilers. March 1.

Henry Glynn, of Bruton-street, Berkeley-square, and Rudolph Appel, of Gerrard-street, Soho, anastatic printer, for improvements in the manufacture or treatment of paper or fabrics, to prevent copies or impressions being taken of any writing or printing thereon. March 1.

William Edward Newton, of Chancery-lane, London, civil engineer, for improvements in the heddles or harness of looms for weaving, and in the machinery for producing the same. (Communication.) March 2.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, for improvements in expressing saccharine fluids, and in the manufacture, refining, and treating of sugar. March 3.

Frederick Crace Calvert, of Manchester, Lancaster, professor of chemistry, for improvements in manufacturing iron, and in manufacturing and purifying coke. March 4. Four months.

John Henry Johnson, of Lincoln's-inn Fields, Middlesex, and of Glasgow, North Britain, gentleman, for improvements in weaving carpets and other fabrics, and in the machinery and apparatus employed therein. (Communication.) March 4.

William Sinclair, of Manchester, Lancaster, engineer, for certain improvements in locks. March 8.

John Blair, of Irvine, Ayr, North Britain, gentleman, for certain improvements in beds and couches, and other articles of furniture. March 9.

Perry G. Gardiner, of New York, United States, civil engineer and machinist, for improvements in the manufacture of malleable metal into pipes, hollow shafts, railway wheels, or other analogous forms, which are capable of being dressed, turned down, or polished in a lathe. March 10.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for combing wool and other fibrous substances. (Communication.) March 15.

Alexander Cunningham, of Glasgow, Lanark, North Britain, iron-master, for improvements in the treatment and application of slag, or the refuse matter of blast furnaces. March 15.

William Charles Scott, of Camberwell, Surrey, gentleman, for improvements in the construction of omnibuses and other public and private carriages. March 15; four months.

William Stirling Lacon, of Great Yarmouth, Norfolk, gentleman, for improvements in the means of suspending ships' boats, and lowering the same into the water. March 16.

John Mercer, of Oakenshaw, Clayton-le-Moors, chemist, and John Greenwood, of Irwell Springs, Bacup, Turkey-red dyer, both in Lancaster, for certain improvements in preparing cotton and other fabrics for dyeing and printing. March 17.

Charles Middleton Kernot, of West Cowes, Isle of Wight, doctor of philosophy, and William Hirst, of Manchester, Lancaster, manufacturer, for certain improvements in the manufacture of woollen cloth, and cloth made from wool and other materials, and in machinery or apparatus for manufacturing the same. March 17.

John Ramshottom, of New Mills, Derby, engraver, for certain improvements in machinery or apparatus for measuring or registering the flow of water and other liquids or vapours which machinery or apparatus is also applicable to registering the speed of and distance run by vessels in motion, and also in obtaining motive power, and other similar purposes. March 17.

John Wallace Duncan, of Grove-end-road, St. John's Wood, Middlesex, gentleman, for improvements in engines in applying the power of steam or other fluids for impelling purposes, and in the manufacture of appliances for transmitting motion. March 22; four months.

Edward Mosely Perkins, of Mark-lane, London, for improvements in the manufacture of cast metal pipes, retorts, or other hollow castings. March 22.

Charles Barlow, of Chancery-lane, London, for improvements in rotary engines. (Communication.) March 22; four months.

William Pidding, of the Strand, Middlesex, gentleman, for improvements in mining operations, and in machinery or apparatus connected therewith. March 22.

James Joseph Brunet, of the Canal Iron-works, Poplar, Middlesex, engineer, for certain improved combinations of materials in ship-building. (Communication.) March 22.

Emanuel Charles Theodore Croutelle, manufacturer, of Rheims, France, for certain improvements in machinery or apparatus for preparing woollen threads and other filamentous substances for weaving. March 22.

William Symington, of Trafalgar-place, West Hackney, Middlesex, gentleman, Charles Finlayson, of Manchester, and John Reid, of the same place, gentlemen, for improvements in flues, and in heating air, and in evaporating certain liquids by heated air. March 22.

LIST OF IRISH PATENTS.

From 21st of February, to the 16th of March 1852.

George Gwynne, of Hyde-park Square, Middlesex, Esq., and George Fergusson Wilson, managing director of Price's Patent Candle Company, of Belmont, Vauxhall, for improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night lights, and soap. February 24.

Hermann Turck, of Broad-street Buildings, London, merchant, for improvements in the manufacture of resin oil. (Communication.) February 24.

William Jean Jules Varillat, of Rouen, France, for improvements in the extraction and preparation of colouring, tanning, and saccharine matters, from various vegetable substances, and in the apparatus to he employed therein. March 15.

Charles Middleton Kernot, of West Cowes, Isle of Wight, doctor of philosophy, and William Hirst, of Manchester, for certain improvements in the manufacture of woollen cloth, and cloth made from wool, and other materials, and in machinery and apparatus for manufacturing the same. March 15.

Sir John Scott Lillie, of Pall-Mall, Middlesex, Companion of the Most Honourable Military Order of the Bath, for certain improvements in the construction and covering of roads, floors, walls, doors, and other surfaces. March 16.

John Wormald, of Manchester, Lancaster, maker-up and packer, for certain improvements in machinery or apparatus for spinning and doubling cotton, wool, silk, flax, or other fibrous substances. March 16.

Henry Glynn, of Bruton-street, Berkeley-square, gentleman, and Rudolph Appel, of Gerrard-street, Soho, anastatic printer, for improvements in the manufacture or treatment of paper or fabrics, to prevent copies or impressions being taken of any writing or printing thereon. March 16.

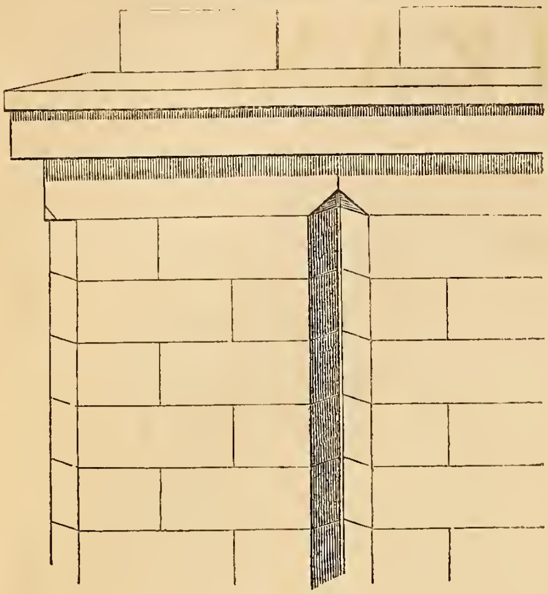
DESIGNS FOR ARTICLES OF UTILITY.

From the 18th March, to the 22nd April, 1852, inclusive.

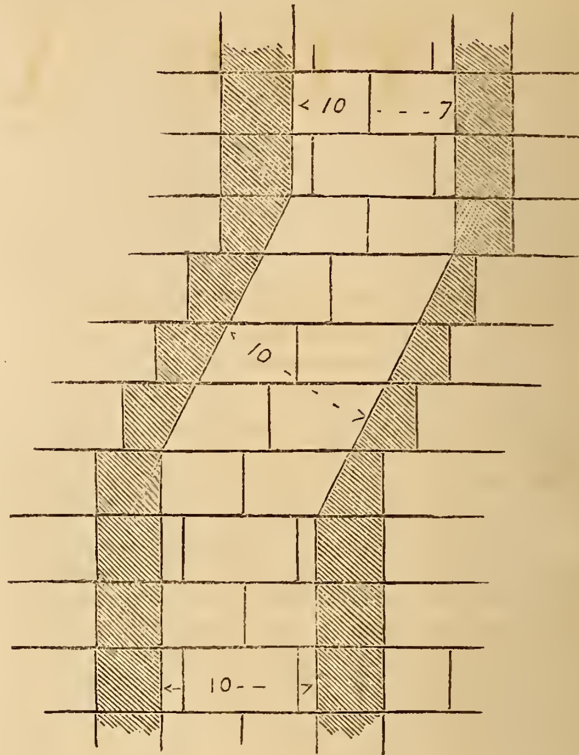
March 18, 3184, T. Lepeinteur, College-yard, Worcester, "Glove-binding."
" 19, 3185, J. Schloss, Friday-street, "Briquet."
" 19, 3186, H. and S. Schloss, Paris, "Vulcan porte-cigar."
" 20, 3187, J. Kimberley, Birmingham, "Tenoning or tenanting-chisel."
" 20, 3188, F. Stammers, Strand, "Facilis fastening for trousers and garments."
" 20, 3189, S. Ellithorn and John Shaw, Preston, "Tuning-key."
" 23, 3190, C. and J. Clark, Street, Somerset, "Elastic gusset for hoots."
" 23, 3191, J. Roberts and W. Winter, Cotton-hill, Nottingham, "Glove-fastening."
" 23, 3192, George Mullin, Glen-house, Guildford, "Ring-stone for grinding grain."
" 24, 3193, J. W. and D. Allen, West Strand, "Elongating portable iron chair."
" 24, 3194, J. Macintosh, Glasgow, "Self-acting balance-seat for carriages."
" 25, 3195, Thomas Whitehead, Leeds, and Samuel Smith, Keighley, "Dead spindle."
" 26, 3196, Simcox, Pemberton and Sons, Birmingham, "Rack pulley."
" 27, 3197, Arthur James, Redditch, "Needle-case."
" 27, 3198, James Coombe and Co., Belfast, Flax-holder."
" 29, 3199, E. D. Maignol Mataplane, South-street, Finshury, "Circular tilting platform."
" 29, 3200, Hall and Wilson, King street, Manchester, "Trimmer or heam for supporting hearth stones."
" 29, 3201, W. B. Johnson, Manchester, "Steam pressure gauge and signal whistle."
" 29, 3202, Michel Roch, South-street, Finsbury, "Letter envelope."
April 2, 3203, W. S. Adams, Haymarket, "Sponging-pan or bath."
" 3, 3204, Fenwick de Porquet, of the firm of Mary Wedlake & Co., Tavistock-street Covent-garden, and Fenchurch-street, "The Utilitarian, or hay and straw-cutting machine with corn-crushing machine combined."
" 3, 3205, John Dangerfield, Hill-top, West Broomwich, "Safety-valve and water indicator for steam boilers."
" 7, 3206, F. Somner, Kelso, North Britain, "Stack or rick ventilator."
" 7, 3207, W. Hughes, Manchester, "Typograph for the blind."
" 8, 3208, E. A. Baker, Whitechapel-road, "Improved gun lock."
" 10, 3209, J. Collins, Birmingham, "Safety lever bolt."
" 10, 3210, E. Poulson, Sunderland, "Reverse levers for shipping."
" 10, 3211, J. Atkin, Huntingdon "Crutch elastic.'
" 10, 3212, W. Weild, Manchester, "Pipe cutter."
" 10, 3213, J. Howard, Berners-street, "Circular extending and ohlong dining table."
" 14, 3214, J. Fletcher and Co., Glasgow, "Duplex reversible and expanding cap."
" 14, 3215, J. Brooks, Birmingham, "Clog."
" 14, 3216, O. L. Detouche and E. Brisbart, Castle-street, Holborn, "Electro-magnetic clock."
" 15, 3217, George Bower, St. Neot's Hants, "Gas cooking stove."
" 15, 3218, H. J. and D. Nicoll, Regent-street, "Front part of a donble breasted coat."
" 15, 3219, W. Longdon, Manchester, "Safety noseband."
" 17, 3220, R. Mead and Sons, Frome, Somerset, "Hat body."
" 17, 3221, G. Bowden, Little Queen-street, "Porte tableau, or artists' sketch and printing safety portfolio."
" 21, 3222, I. Harris and H. Shorthouse, Kingsbury, "Turnip cutting machine."
" 22, 3223, P. Hunter, Edinhurgh, "Churn."

MOON'S PATENT CHIMNEY BRICKS.

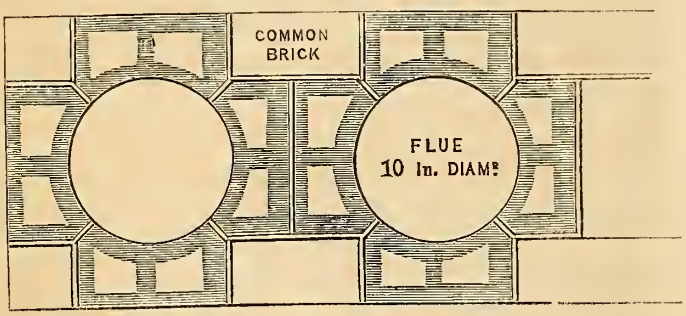
External Elevation of Shaft.



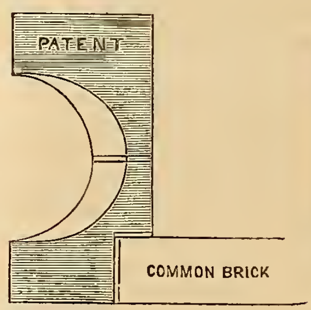
Section of Flue.



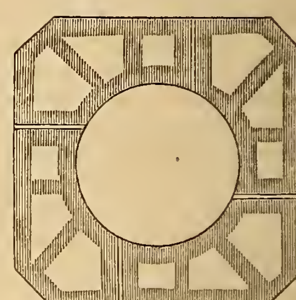
Plan of Bond Course.



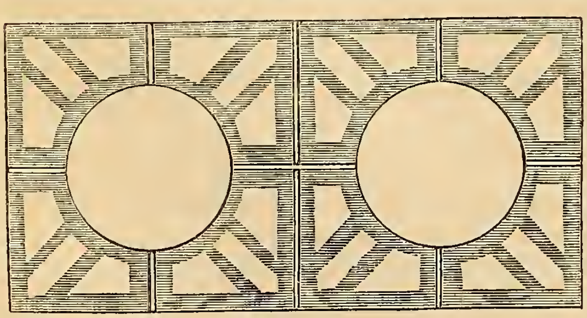
Gathering Brick.



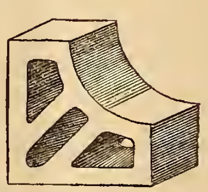
Plan of Shaft Bricks.



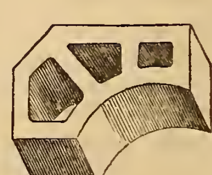
Plan of Stretcher Course.



Bricks for Bond Course.



Bricks for Stretcher Course.



Bricks for External Shafts.

W. K. Whytehead, C.E., direx.

THE ARTIZAN.

No. VI.—Vol. X.—JUNE 1st, 1852.

LOCOMOTIVE ENGINEERING IN AMERICA.

BY ZERAH COLBURN.

(Concluded from page 105.)

COAL *versus* WOOD, AS FUEL.

The coal-hurning engine, built hy Ross Winans, of Baltimore, and placed by him for trial on the Boston and Maine railroad, had 17-inch outside cylinders, laid horizontally, 22-inch stroke, and eight drivers, having chilled rims 43 inches in diameter; all the drivers being placed hetween the fire and smoke boxes. The connecting-rod is applied to the third pair of wheels from the smoke-box. Thc distance hetween the centres of the extreme axle is 11 feet 3 inches; between the centres of the cylinders, 6 feet 5 inches. The hoiler shell is made of $\frac{5}{16}$ iron, and measures, in its smallest inside diameter, 41 inches. There are 101 two-and-a-half-inch and 2 two-inch wrought-iron tubes, 13 feet in length. The upper row of tuhes is nearly up to the top of the cylinder part of the hoiler, *the water-level being in the dome above the waist of the boiler.* The dome is formed a little forward of the middle point of the hoiler, having the same diameter, and rising 51 inches ahove it. There is a step on the hack side of the fire-hox, making the length of the grate 14 inches more than the length of the crown-sheet. The fire-box is of $\frac{3}{8}$ inch copper, with the exception of the tuhe-sheet, which is of $\frac{1}{2}$-inch iron. Length of grate, $56\frac{1}{2}$ inches; at crown-sheet, $42\frac{1}{2}$ inches; mean hreadth of grate, $42\frac{1}{2}$ inches; at centre of boiler, or middle row of tubes, $39\frac{1}{2}$ inches; all inside measures. The whole depth from the crown-sheet to grate, is $51\frac{1}{2}$ inches.

The grate-hars are very heavy, and are cast but two together. Their ends come through the bottom of the fire-hox, on the back-side, and have round holes through which to put a har to stir them occasionally, in order to loosen the cinders and melted coal. The exhaust from both cylinders comes through a cast-iron hox, or hlast-pipe, having moveahle sides, so that the aperture at its mouth may be varied from $3\frac{1}{4}$ to 10 square inches. There is a pipe ahout 9 inches in diameter, passing up through the smoke-hox, from the bottom to the top, and entering the chimney, leaving a few inches all round it for the smoke to rise through. The exhaust enters this pipe at its hottom, and the partial vacuum created hy its action supplies the blast, as in ordinary locomotivcs. The tuhe surface of this engine is 860 square feet; of heating surface in fire-box, 66 square feet; and the area of grate is $16\frac{2}{3}$ square feet.

Messrs. Slade and Currier, civil engineers, were commissioned to make experiments with this engine, in order to institute a comparison hetween it and a first class wood engine, but more particularly to test its actual value as a coal-burning engine. The results of their experiments have heen puhlished, but they neglect to state that the "New Hampshire" (the wood engine) was of a materially different pattern from "the Coaler," inasmuch as it had six driving wheels and a truck frame, thereby losing a considerahle per cent. of the adhesion due to its weight, as compared with the "Coaler." The dimensions of the "New Hampshire" were as follows:—16-inch cylinder; 20-inch stroke; diameter of drivers, 46 inches; length of tuhes, 10 feet 6 inches; diameter of boiler, 45 inchcs. This engine was huilt hy Hinkley and Drury.

The experimental trips were made in the latter part of January, and in the beginning of February, 1850. The entire distance from Boston to Great Falls is given as 74 miles. There was more or less snow on the tract during the time in which the experiments were made. The highest grades were ahout 47 feet per mile. One point unfavourahle for the "Coaler" was the fact, that from there heing hut about 26 miles of douhle tract, the freight trains were suhject to frequent and protracted delays, in waiting for passenger trains to pass. In waiting, the fire in the wood engine could he suffered to go nearly down, the fire hox heing filled with wood when the train came in sight. In the coal engine, however, it was necessary to keep the furnace filled with coal, as, if suffered to get down, it would take considerahle time to recover the fire.

With the "Coaler", the average of ten trips showed a consumption of 4,786 lbs. anthracite coal to evaporate 3,512 gallons in going 74 miles; this heing 10.31 lbs. coal required to evaporate one cubic foot of water.

With the wood engine, 3 cords and $\frac{4}{10}$ of a foot of wood of various qualities and prices were used to evaporate 3,734 gallons of water.

The cost of carrying 15,000 tons one mile with wood was found to

he	14.04 dol.
With coal	12.70 „
Favour of coal	1.34 dol.

The wood engine had a sand hox, and had wrought-iron tires. The "Coaler" had a sand hox also, but had chilled wheels.

The "Coaler" took 76 cars, weighing, with freight, 433 tons, up Ward Hill, in Bradford, where there is a grade of 47 feet per mile, and also a very bad reversed curve. In going up the hill, no sand was used, nor did the wheels slip, except, as the report states, some three or four turns where some track repairers had taken off a hand car, and left a little snow on the rails.

The wood engine took 61 cars up the same hill, weighing, with freight, 391 tons. Sand was constantly running from the sand hox, except when, to ascertain whether the engine was working up to its full power, the sand was turned off, when the wheels were found to slip very much.

The average cost of wood used on the through trips was 3.63 dollars per cord.

The cost of anthracite coal per ton of 2,240 pounds, was 5.25 dollars; $\frac{5}{8}$th of a ton of coal was found to he equal in effect for evaporation to one cord of wood, or 3.28 dollars worth of coal equal to 3.63 dollars worth of wood.

The average speed of the coaler, although having a smaller wheel and a longer stroke, was found to he $\frac{2}{10}$ of a mile per hour greater than that

of the wood engine. Their average speeds being $14\frac{3}{10}$ and $14\frac{1}{10}$ miles per hour, respectively. This was probably owing to a loss on the wood engine by slipping the wheels.

In conclusion, the commissioners express their opinion that, for running heavy trains, which are not obliged to wait for any considerable length of time along the line for other trains to pass, they believe coal to be every way more economical than wood. They also say that in their remarks they would not wish to be considered as in any way disparaging the "New Hampshire," as they consider tbat a first-class wood engine.

Winans has an express engine on the Worcester road, having 7 feet drivers. In this engine, however, tbe proportions of the hoiler, &c., are very much the same as in the freight engine we have noticed. These seven feet drivers were cast with chilled rims, and were of an extremely light pattern; in fact they became broken before they had heen used two months. There were two small steam cylinders placed on the sides of tbe boiler over the bearings of the driving axle, by which the weight on the drivers could be varied from three to twelve and a half tons. But when under their utmost adhesion, the drivers were found to slip very much.

USE OF ANTHRACITE.

Many attempts have been made to hurn anthracite coal effectually and economically. Winan's engines appear best adapted for the use of this kind of fuel of any yet constructed. We regard, however, a very large extent of grate with a moderate depth of coal as still more likely to attain to superior results. For a 17-inch cylinder, let the grate be 6 feet by $3\frac{1}{2}$ feet, the depth of fire-hox being 3 feet, and having two or three water bridges 4 inches in thickness traversing its entire length. We are of opinion that anthracite might be burned in such a fire-box with increased effect in the production of steam and with a diminished waste in the metal of the fire-box and grate bars. With such a furnace a pair of small wheels would be necessary to support the hind end of it.

The difficulties encountered in the use of hard coal arise chiefly from the intense and concentrated heat involved in its combustion, thereby destroying the grate bars and *scaling* the inside of the fire-box. This rapid burning out of the grate has led to leaving off the ash pan on the coal engine on some of the Pennsylvania roads, which appears to remove to some extent the destructive results attending the use of the coal. The ashes and cinders falling upon the track, if they do not *immediately* cause a fire, wbich must be guarded against, soon form an impenetrable crust along the entire line, which removes all further danger from that source. This, though it may appear somewhat improbable at the first view, accords with the experience of the roads where it has been tried. Much difficulty has been met in the use of copper tubes, as the action of the coal, from being projected in small pieces hy the blast, was found to cut them away near their mouths. This difficulty suggested the use of wrought-iron tubes, which, however, require mucb caution in setting them, as the increased force necessary to head up their ends is apt to spring or bend the tube sheet. A metbod has been practised with much success on the Pensylvania roads, which is to turn off an inch or more of the end of the wrought-iron tube in the form of the frustrum of a cone, therehy reducing its thickness one half at its extreme end. The tube is then placed through the tube sheet, and a thin thimble of copper, an inch in length, and previously turned off in the same manner as the tubes, is driven into the mouth of the tube, with its sharpest edge foremost. After heing driven as far as it will go, the thick edge projecting outwards is turned over and headed in the usual manner.

The creation of sufficient blast by the action of the exhaust steam has also been attended with some difficulty.

Anthracite requires for its proper combustion a very steady and quite powerful blast, which the intermittent and fitful action of the blast-pipe of a locomotive fails of producing. It has been attempted by many arrangements, however, to render this kind of blast regular and capable of giving the required intensity to the fire. The pipe described as passing up through the smoke-box of Winan's engine, has this result for its object. Although steam enters the bottom of this pipe by sudden and violent impulses, the pipe must be filled with steam, which will issue in a very regular manner from the top of it, where its action is first employed in causing a draught through the tubes. It has also been tried to obtain a regular blast hy letting the exhaust steam into a receiver or box a foot in diameter and a foot high; this box being in the middle of the smoke-box. Eighteen 1-inch tubes in the top of tbis box afforded exit for the steam. This plan, however, from the resistance caused by the steam on the reverse side of the piston (being solicited to escape through so difficult a passage), has rendered its operation inefficient.

If future experience determines the exhaust steam to be insufficient to give a proper blast for burning anthracite, it will hecome necessary to adopt some of the varieties of bituminous coal, or a mixture of anthracite and bituminous coal. We think, however, the exhaust steam will be found sufficient for burning the former, under ordinary circumstances, with a large extent of fire-hox surface.

COST OF LOCOMOTIVES.

The following is an estimate which bas been furnished us of the expenses of running a first-class passenger engine 100 miles a day for one year.

Wages of engineman	$720.00
,, fireman	360.00
Wood, 4 cords per day, 280 days, 1,120 cords at $4.50 per cord	5,040.00
Oil, 280 gallons at .80	224.00
Waste, 840 lbs .02	16.80
Repairs, 28,000 miles, .06	1,680.00
Water in Boston	100.00
Water and pumping on road	150.00
Interest on first cost of engine	480.80
Total	$8,770.80

Below we give estimates of the weights of some of the *principal* parts about a locomotive, and about the average prices usually charged for such items.

42-inch boiler, 7,500 lbs., at 14c..	$1050·00
135 $1\frac{3}{4}$-inch copper flues, $10\frac{1}{2}$ feet long, 2,500 lbs., at 30c.	750·00
Turning and driving thimbles, setting do., &c ..	30·00
Solid engine-frame, 2,500lbs., at 6c.	150.00
Jaws of wrought iron, 1,000lbs. at 10c.	100·00
Finishing frame	150·00
4 Driving wheels, for $5\frac{1}{2}$-feet diameter, 6,000lbs. at 3c.	180·00
1 crank axle, $6\frac{1}{2}$ inches finish, 1,500lbs at 18c. ..	270·00
1 straight axle, 650lbs. at 10c.	65·00
2 truck-axles, 3 $\frac{1}{2}$-inch journals, 480lbs. at 6c. ..	28·80
4 truck-wbeels, 30-inch diameter	70·00
4 Lowmoor tires, $5\frac{1}{2}$ feet, 2,850lbs at 13c. ..	370·00
Finishing wheels, cranks, and axles	200·00
2 cylinder castings, 15 inches in diameter, 1,600 lbs. at 3c.	48·00
Boring cylinders	50·00
2 rough connecting rods, 360lbs. at 8c.	28·80

THE GAUGE QUESTION.

At the introduction of railroads, engines were built with cylinders no larger than 8 inches in diameter. In 1840, we think there were no engines with cylinders larger than 12 inches. In 1844, we had 13½-inch cylinders by 47. 15 inches; and now, Perkins, on the Baltimore and Ohio road, is building an engine with a 20-inch cylinder. The gauge of our roads remains the same now as it was a dozen or fifteen years ago—four feet eight and one-half inches inside the rails. In those days two trains per day, drawn by the light engines, were all which the business on a road would warrant. Now, we have twenty to thirty trains drawn over our principal roads daily, by engines averaging from twenty to twenty-five tons in weight. These facts are sufficient to show a vast increase of business wherever railroads are extended. This constantly growing traffic must, at no distant period, demand the adoption of a wider gauge for our tracks. Railroad men prefer engiues with inside cylinders to those having the cylinders outside. Every engine requires apparatus for reversing and for working expansively, and no better means, we think, have yet been found to effect these objects than the use of six eccentrics. Here the insufficiency of the width of the track becomes evident; it is only by economising every inch of room that sufficient space can be found to arrange the work of an inside cylinder engine. It would be a matter of very great convenience were the track wider than at present, and we believe that the experience of a dozen years at most will determine it to be a matter of absolute necessity. The gauge of the Atlantic and St. Lawrence, and the Audroscoggin and Kennebec roads, in Maine, is five feet six inches inside rails, and that of the New York and Erie railroad is six feet. Wherever a break of gauge is made, it would seem of importance that the addition in width should be uniform on all roads, as a difference in tracks disturbs the traffic, inasmuch as no means exist of forwarding goods by such roads, except by changing cars.

RAILWAY REPAIRING SHOPS.

Every railroad doing any considerable amount of business should have sufficient and capacious repair shops of its own. The increased facility and convenience with which they can do their own repairs, and the saving in the profits which outside shops charge them, make it a matter of economy to repair their own work. For a railroad having 15 to 20 locomotives, a shop 120 by 60 feet, and one story high, if properly laid out, makes a very convenient repair shop. For such a shop there would probably be required for tools, &c.,—

One stationary steam engine (25 horse), say ..	$1,500
„ Locomotive boiler, with wrought-iron flues ..	1,800
„ Large engine lathe, to swing 6 feet	1,500
„ 14 feet planing machine	800
„ 12 feet engine lathe, with screw feed	350
„ 12 ditto without ditto	300
„ 10 ditto ditto	250
„ Hand lathe for iron	175
„ Ditto for wood	125
„ Bolt cutting machine	250
„ Wall drill	125
„ Suspended drill for tires	125
„ Machine for drawing on wheels	50
„ Blower for blacksmith's shop	50
„ Forge hammer	400
	$7,800

We merely give the above estimate to show with how few tools and at how little expense the repairing department of a railroad may be conducted. In arranging such a shop, however, the fancy or belief of many would lead them to have many additional tools, such as one 16-feet engine lathe, a compound planer, (the expense of these two being about 1,000 dollars); and for an increased business, some would think a spliner (500 dollars) and some other tools necessary. We know, however, of some roads having twenty locomotives, and doing all their repairs with a list of tools such as is comprised in our original estimate.

COTTON AND ITS MANUFACTURING MECHANISM.

By Robert Scott Burn, M.E., M. S. A.

(Continued from page 101.)

In the machine we have described, for opening and cleaning cotton, the "wool," as it is termed, is passed from it in a loose state, either discharged on the floor or into a basket. In this state the cotton is geuerally taken to the next machine, called the "scutcher," and laid by hand upon the feed-apron; it is from this machine, wound upon a roller, and termed a "lap," ready to be taken to the next machine—the carding engine. It would obviously be an improvement, could the wool from the willow be passed on to rollers and wound thereon, these being taken to the scutcher with greater ease than while in the loose state. This desideratum is proposed to be effected by an ingenious attachment to the ordinary willows in use, which we shall, by the aid of a simple diagram, now endeavour to explain. It is the invention of Messrs. Mason and Collier, of Rochdale and Halifax. The cotton from the main cylinder, provided with the tearing teeth, as above described, is taken up by the two rollers, *a b* (fig. 1), the under one of

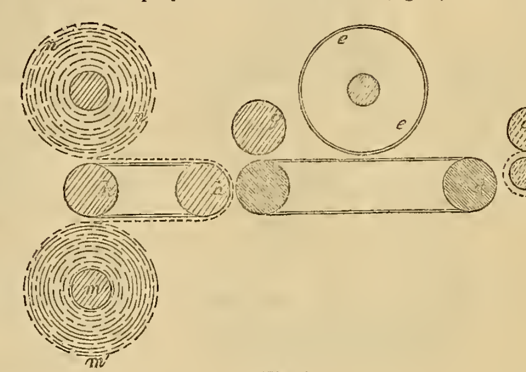


Fig. 1.

which is fluted on its surface. These pass the cotton to the endless apron, wound round the two rollers, *c d;* on its passage along this apron, it is compressed by the revolving cage, *e e*, into a flat lap; this is passed between the roller, *g*, and apron, on *c d*, to a second endless apron on the rollers, *h h*. For cotton, in its ordinary state, the drum, *e e*, is made hollow, and its outer periphery of wire-gauze or other perforated metal. A partial vacuum is maintained in the interior by an exhausting fan. The consequence of this arrangement is, all loose dust or extraneous matter existing in the cotton, while passing over the first endless apron, is passed through the perforations and led off to any convenient point of exit. The cotton is taken from the second endless apron, and delivered to the lap roller, *h h*, in the following ingenious manner. Beneath the roller, *h*, another roller, *m*, revolves; round this is wrapped a long continuous cloth, shown by the dotted lines; this is passed under the endless apron, *h h*, over the end roller above the apron, and is finally wound upon the lap roller, *n n;* from this arrangement the wool is delivered to the cloth, and is lapped round *n n*, the cotton lying between the folds of the continuous cloth. On the lap-roller being filled with its determinate length of cloth and cotton, it is taken out of its bearings and an empty one put in its place. While on this department, it may be as well to notice an invention by the same gentlemen, applicable to machines for separating cotton from its ad-

hering seeds. This is exemplified in diagram fig. 2. *c* is the revolving saw; *e*, the roller revolving nearly in contact with the concave plate, *b*. The cotton passes between the roller and concave plate; this arrangement serves to keep the cotton close up to the revolving saw, so that it is cleaned better and quicker than where this position is not obtained. This arrangement seems likely to be efficient.

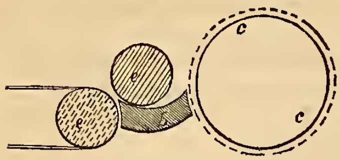


Fig. 2.

An improved form of willow or cotton opener has been recently patented by Mr. Christie, of Salford, which possesses some points of novelty; we shall very briefly describe it. The principal peculiarity consists in holding the cotton —while passing through the feed rollers— at intervals, thus presenting the fibres for some time to the beating or opening action of the main cylinder. This is effected by giving the rollers not a continuous, but an intermittent, movement; while the rollers remain motionless, the cotton is held in one position, but is passed on when they begin to move. The intermittent motion of the feed rollers is produced very simply, thus :—At the extremity of one of them a small ratchet wheel is fixed, and on the axis a loose three-armed lever; in close proximity to the feed roller a wheel is placed, having on its face two projecting studs; one end of the three-armed lever is formed into a click, which catches in the teeth of the ratchet wheel; the other end is weighted, while the third is operated upon by the studs in the face of the wheel above described. As this wheel revolves, the studs strike the end of the lever and actuate the click, and by this means the feed roller; on the stud passing, the end of the lever is relieved, and the weighted arm brings the click into a position ready to act on the ratchet teeth, as soon as the next stud strikes the lever. The cotton opener and cleaner to which this intermittent feed apparatus is attached possesses also some novelty of arrangement. A revolving inner case has on its outer periphery a series of projections or beaters; these pass between similar projections made in the inner periphery of the outer case or cover of the machine. The lower part of the cover is made of a grating, as usual in such machines, the dirt and extraneous matter passing through it. The cotton, after being thoroughly opened by the projecting beaters, is passed through a trap made in the case opposite to the side at which the cotton is fed to the machine; this trap is opened and shut at intervals, by means of a flexible door or cover. These intervals are so arranged, that the beaters have ample time to act on the cotton contained within the machine. On the door being opened, the wool is projected on to the periphery of a revolving perforated cage, the interior of which is partially exhausted by a fan; passing from this cage to an endless apron, it is passed to the floor in baskets prepared for its reception. The flexible door which covers the trap in the case, is partially wound upon a roller. This roller receives motion at intervals by the following simple means :—A rack segment is provided with a lever actuated by a rod attached to the upper end; the other extremity of this rod is alternately struck by the studs placed on the face of the wheel, which gives motion to the feed rollers, as before described. As the studs strike the end of the rod, the lever attached is moved; this actuates the toothed segment, and through it the roller on which the flexible cover of the trap is partially wound.

The cotton wool thus cleaned is now ready to be taken to the machine next in sequence; namely, the " scutcher," or " blower," as it is more frequently termed. The object of this machine is to open still more thoroughly, than was effected by the willow, the fibres of the cotton, and to free them from their still-adhering particles of extraneous matter. Its principle consists in beating the fibres of cotton as they exude from between two rollers, by means of arms of a rapidly revolving beater or scutcher. Thus, in fig. 3, *a a* are the feed rollers, *b b* the revolving beaters or scutchers, the rate of revolution of which is

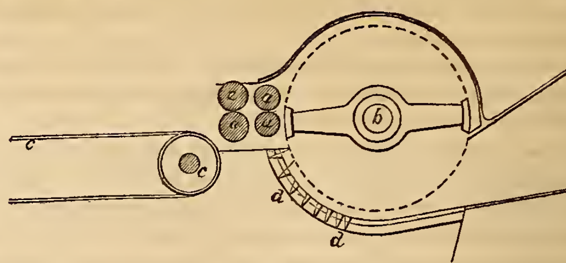


Fig. 3.

between 1,800 and 2,000 turns per minute; the cotton, as it is passed from between the feed rollers, is struck violently, the dirt passing down through the apertures of the grating, *d d;* beneath, a revolving fan draws off to a convenient place all the particles of dirt. In some forms of "blowers," the wool, after passing the beaters, is at once projected on the floor in a loose state. In such cases, the cotton is again subjected to the action of beaters in a second " blower," but, instead of being sent out loosely, the fibres are lapped round a roller, and termed " laps." The most improved form of "blower," however, is that in which the scutching and lapping are produced in one machine. In this the cotton taken from the willow is fed by hand to the blower, being placed upon an endless apron, as *c c*, fig. 3, and passed to the feed rollers; on exuding from which it is struck by the beaters, the dirt passing through the interstices of the grating below. The cotton fibres are then wafted up an inclined endless apron, passed between a revolving cage, thereafter to rollers; on exuding from between which, the cotton is struck a second time by beaters. These beaters revolve more rapidly than the first pair. The cotton is next passed to a second endless apron, under a second revolving cage, passed between two iron rollers, which, being pressed together, in a manner felts the cotton; and it is finally wound round a wooden cylinder, termed the "lap cylinder." The axis of this being loaded by hanging weights, it bears down between two rollers, which, by their friction, make the lap cylinder rotate. As the lap cylinder becomes filled, it is evident that its diameter increases; this causes it to rise in the slotted bearings, in which it revolves, carrying along with it the links which support the hanging weights. When the lap cylinder has attained the determinate size, the supply of cotton is stopped by very simple means; namely, by throwing out of gear the beaters, endless aprons, &c., while the rollers turning the lap cylinder are allowed to rotate, the delivery rollers no longer giving out the scutched cotton while the lap cylinder revolves; the consequence is, that the lap is torn across in the direction of its breadth. The filled cylinder is then removed, an empty one is put in its place, and the beaters, &c., thrown into gear. The next machine which we have to notice is the "lap" machine, the description and diagram of which we shall reserve for our next.

(To be continued.)

WORTHINGTON AND BAKER'S PATENT STEAM-PUMP.

In describing the application of this steam-pump to Mr. Copeland's fresh-water apparatus (*vide* p. 73), we promised to give details of this particular portion of the arrangement; a promise which we now redeem. We have had an opportunity of seeing it again at work at King's Cross Station, and are able to express our entire satisfaction with its performance. Those who do not mind waiting some ten or twenty years, *may* get a constant high-pressure water-supply, according to Act of Parliament; but any restless spirits have the opportunity of obtaining this result by their own act, and of rendering themselves independent of either water-companies or fire-insurance offices, by fixing such an engine as this, which would serve for a whole block of

houses and factories. We should like to enlarge on this subject, but for the present we must forget the iniquities of water-companies, and proceed with our analysis.

Fig. 1 is an elevation of section, and fig. 2 an end view, of the steam-engine and pump, constructed on Worthington and Baker's patent, drawn to a scale of $\frac{3}{4}$ inch to a foot.

The steam cylinder, *a*, is bolted down to the sole plate, and is connected to the pump by a semi-cylindrical frame, having a flange at each end. The chief novelty in the engine is the improved method of working the valve, by which the concussion usually inseparable from the use of tappits is entirely removed. The slide valve, *b*, is, in fact, two single slide-valves, joined together; the steam passing *under* the valve, through a recess cast in the face of the cylinder for that purpose. The object of this appears to be to diminish the pressure on the back of the valve; but, inasmuch as the valve requires to be enlarged in size, this desirable effect is but partially obtained. To destroy the concussion, the valve is connected by a rod, with a piston, *c*, working in a small cylinder, cast on the back of the slide case, with which it communicates by means of a hole drilled through the cylinder bottom. A small groove is cut in the lower side of the cylinder, and the steam can thus pass on both sides of the piston, forming a kind of spring. When the tappit, *e*, attached to the main piston-rod, strikes either of the bosses, *g g*, the consequent sudden motion of the piston tends to compress the steam behind it, and, as the steam can only escape gradually through the openings, the piston is retarded and brought to a state of rest; and the slide being always opened to the proper extent, the engine works with a smoothness and precision which we could hardly have believed possible, without being governed with a crank. A handle, *f*, which can be readily lifted out of gear with the boss, *g*, serves to move the slide at starting the engine. A stop-valve, *d*, is cast on the slide-case. It is, in principle, like the cock of Mr. Chrimes (*ante* p. 91), the spindle being screwed, and the cover forming the nut. The most convenient way of making these valves is to make the plain part of the spindle smaller in diameter than the screwed part, so that it will pass through the cover; the valve and spindle can thus be made in one piece, and the handle pinned on. These valves are cheaper than large cocks, can be kept tighter, and, not being liable to jamb, are more under control.

The pump is of the double-acting, plunger form, and is provided with circular India-rubber valves, which work without noise. The plunger, *h*, works in metallic packing, which is accessible by taking off the cover at the back of the pump. The pump-barrel is rectangular in section, the top and bottom being formed of the plates which form seats for the valves, of which, *o o* are the delivery, and, *o′ o′* the suction. The valves are simple discs of India-rubber, and are provided with metal guides, which also prevent them rising too high. At each end of the plunger are holes, *n n*, which have the effect, just before the end of the stroke, of opening a communication between the back and front of the plunger, which is designed to mitigate the concussion due to the inertia of the water. Hand-holes, *m m*, are provided, to give access to the end of the pump not furnished with a loose cover. (In plate 6, the letter *r* is erroneously placed on one of the hand-holes, instead of on the suction-pipe. This will be corrected in the second edition.) The chambers at top and bottom of the pump are bolted through the plates containing the valves and the flanges of the pump. To the bottom chamber is attached the suction-pipe, *i*, which is steadied at top by being bolted to the upper chamber, although there is no communication between them. Similar openings are cast on both sides of the pump, so that the suction-pipe may be attached to either side, as may be convenient, the openings on the side not in use being closed with blank flanges. The suction-pipe is provided with an air-vessel, *s**, which gives a more certain supply of water to the pump.

The delivery pipe, *t*, is also provided with an air-vessel, *x*. The stop-valve on this pipe is arranged so as to close either of the two branches, one when it is down, and the other when it is up. As described at p. 74, this arrangement admits of the water being pumped

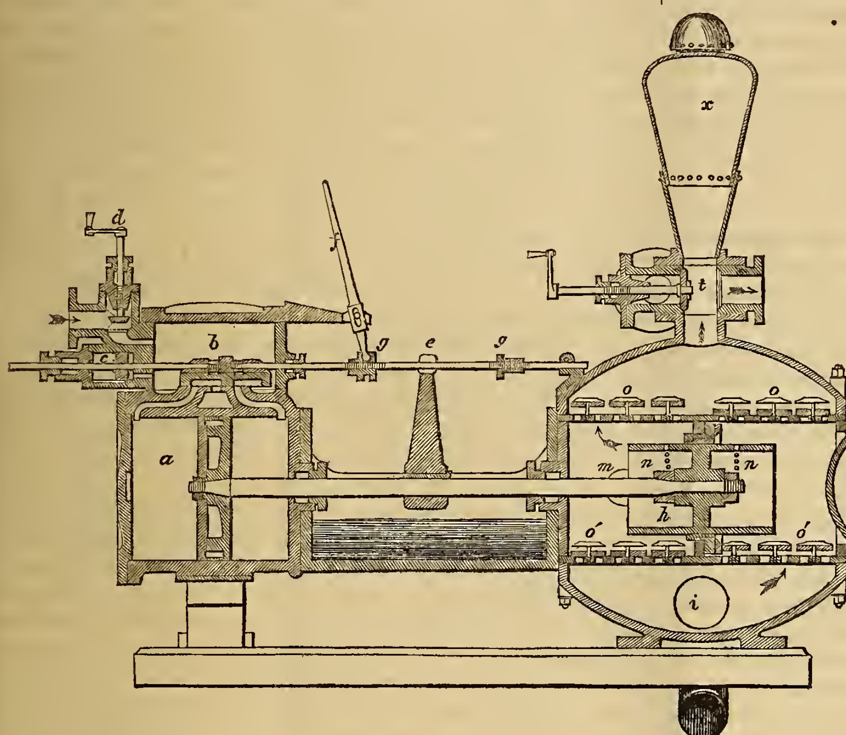


Fig. 1.

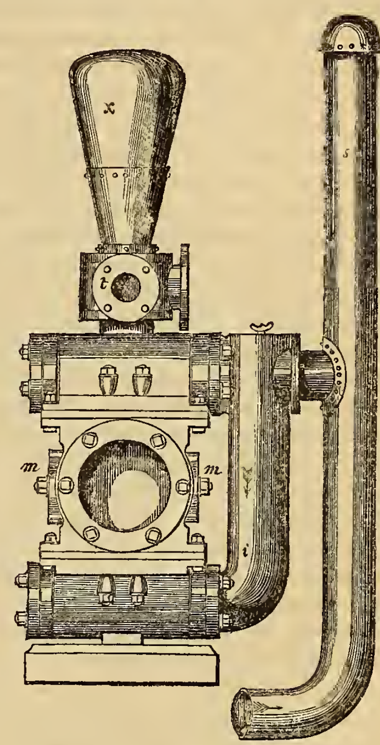


Fig. 2.

* Mr. Carrett, of Leeds, claims the merit of putting an air vessel on the suction pipe, *vide* p. 250, vol. 1850.

through a refrigerator, or applied to washing decks, pumping out bilge water, or to extinguish fire.

This engine and pump looks more complicated on paper than it really is, but if it be dissected, it will be found to bear evidence of having been very skilfully designed, a point on which comparatively few engineers lay sufficient stress.

The following directions are given by the makers :—

Secure the pump in a horizontal position, and so arrange as to have the *suction pipe as short as possible.* The length of the other pipes is unimportant, but the shorter the suction pipe the better will the pump work. It should be made of copper, with brazed joints, and well proved before being attached. Every other kind of pipe, if tight at first, is liable to become imperfect after a time, by the combined action of rust, and jarring. As this pipe is usually covered up, great trouble is caused by the difficulty of finding a leak, should one occur.

A vacuum chamber should be made by carrying up the suction pipe as shown, with an offset reaching to the side pipe; the upper end must be perfectly closed. This arrangement will prevent the "water hammer," and cause the pump to run smoothly.

Dimensions of pipes.—They should be the same size as the holes in the flanches, if not more than ten feet long; add one eighth of an inch to the diameter for every *five* feet additional length.

Fire engine.—The hose should be of the largest size used, and the jet pipe not less than $\frac{7}{8}$ or more than $1\frac{1}{4}$ inch diameter.

Heating of the pump.—It sometimes happens that a pump will get so heated as not to work. This is caused either by the water getting back from the boiler when the pump is stopped, or else by the water in the heater becoming too warm to be pumped. To guard against the water from the boiler, as also to allow of opening the pump when it may be necessary to look at the valves, *a good tight stop-valve,* at or near the end of the force pipe, is required *in all cases where the pump is applied to feed a boiler.* If this valve should become leaky it will cause trouble. In case a pump should get hot and refuse to throw, it must be cooled by pouring water upon the cylinder and pipes.

To start the pump.—At starting, let on steam gradually, by opening the screw valve, and work the valve rod back and forth for a little while with the starting bar, until the steam cylinder is warmed up and the pump catches water; after which, set the steam cock to give the required speed. It is much more economical, and every way better, to keep the machine always moving just fast enough to supply.

If, upon trial, the steam valve is not thrown with quickness and certainty, the tappits or nuts on the valve rod, at the end where it fails, must be carried *farther from the middle of the valve rod.* If, on the contrary, it is thrown so forcible as to be noisy, they must be brought nearer *to the middle of the valve rod.* First loosen the nuts, and then make this adjustment while the machine is in motion, by screwing back or forth *a little at a time,* until the exact point is found where the pump runs smoothly at all speeds. Then tighten up the nuts, using two wrenches, to avoid throwing any twist upon the rod. These nuts are very nearly right as they are now set, but a little adjustment is necessary for each particular case.

Causes of failure.—Any unsteady motion of the machine proves either that the water valves do not come to their seats, or else that the pump gets air. In such case, therefore, first examine the water valves through the hand-hole plates, to see that no chip or sediment prevents their closing. If the pump does not run properly, the joints about the suction pipe, as also the pipe itself, must be examined. As a very small leak will destroy the action of a pump, this examination should be very thoroughly made. If the machine appears to need it, a little good oil may be poured into the steam chest occasionally.

To change the flanches.—The side pipe will fit on either side. A bend in the pipe may thus be saved, and at the same time the valve cover be brought in front, where it can be easily taken off when necessary. The exhaust flanch may be also changed by unscrewing it.

Accidents from frost.—In cold weather great care should be taken at night to empty every part of the pump and all the pipes. The condensed steam must also be drawn off from the steam and exhaust pipes. If possible, the pipes should be so put up as to allow the water to run to the ends without lodging in the bends. The cylinders are provided with screw plugs for drawing off the water. There are several on the underside, which should not be overlooked.

Lifting water.—If a pump is applied to feed a boiler, it should not be required to lift or suck the water through a distance greater than fifteen feet at the farthest. If it is to be heated before going through the pump, the water should, as a general thing, be on a *level with,* or, if possible, *above* the pump. But if the water is only to be drawn up and forced into a reservoir, the suction may be increased to twenty-five feet if necessary. A foot valve on the bottom of the suction pipe is necessary for all distances over ten feet.

Repairs.—After ten or twelve months' service, the steam slide valve should be examined, as it may require to be re-faced; any mechanic acquainted with such business can easily do this. In course of time the water plunger will also be cut or worn; to repair it, take off the nut from the end of the piston rod with the socket wrench sent for this purpose; then draw out the plunger, also the ring through which it works; put the plunger upon a mandril, and turn it off exactly to fit the ring, which must either be bushed, or a new one cast and bored out. Be careful to have the plunger work easily through the ring from end to end; put back the plunger with the *marked end out.* A spare ring and plunger will always be furnished on short notice. The ring is made adjustable, so as to be followed up by keys which close it down upon the plunger, and thus make it serviceable for a long time.

Proper working speed.—For this size 80 to 100 strokes per minute. In cases of emergency, such as *fire or a leak,* it may be run much faster, but never as a regular thing.

Errors that occur in Practice.

Considerable experience has shown the difficulties which arise from neglect of these directions. They should be preserved and kept for future reference.

Suction pipes.—Inattention to the size and quality of this pipe, causes more trouble than any other defect. Some will insist upon drawing water through two or three hundred feet of bored logs that admit the air at every joint, as well as through the pores of the wood. Others use an inch pipe, where three inches are required. Others again put down iron pipes, with numerous joints, which they never prove; and many pipes, otherwise good, are fitted with leaky cocks, or connect with other pumps that are leaky. As the pump gets the blame in such cases, it is fair to say that, to run well, *this pump requires a suction pipe that will not leak air, and of sufficient size to fill the cylinder as fast as the plunger recedes.*

Pumping hot water.—The approved system of heating the water, is by forcing it through a coil in the force pipe. There are many, however, who still adhere to the vicious method of heating the water before it goes into the pump. This always has, and always will, render the action of any pump very uncertain. It is likewise wasteful, for under the best of circumstances, the water can only be heated to about 180°. The remedy is either to change the arrangement, or to use a pump much larger than is necessary, so as to ensure a supply when pumping a small portion of water, and a large one of vapour.

Altering the nuts on the valve rod.—After these nuts have been once properly adjusted, they should be let alone; it is a common error to move them every time the pump fails—no matter from what cause. Hence we have often found a pump of nine inches stroke working only

three. If the pump fails to work, the water valves or pipes are probably at fault.

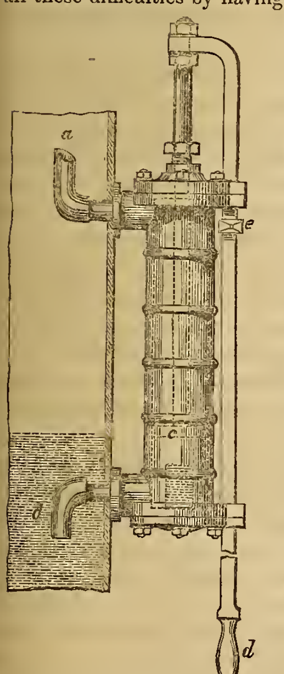
Running the pump too fast.—If a chip happens to get under the water valve, it is common to run the pump faster to make up for the leak, instead of removing the obstruction. Some let the pump stand quiet until the water gets low, and then run it at the utmost speed. This excessive speed is almost sure to injure the pump.

Strainer on the suction pipe.—No strainer at all, or an imperfect one, allows chips and dirt to pass into the pump, so as to interfere with its action. In some places this causes great delay and trouble, for which the pump is usually condemned, instead of the pipe.

Freezing.—Accidents from this cause are constantly occurring, which strict attention to the *directions* would obviate.

WORTHINGTON AND BAKER'S PATENT PERCUSSION WATER-GAUGE.

The maintenance of a due supply of water in the boiler of a steam-engine is, perhaps, without exception, the most harassing part of an engineer's duty, either on land or at sea. We remember once meeting an old acquaintance, who had been tempted by liberal pay to serve under a foreign steam-boat company for three years, without having a "second," in whom he could put confidence. To a query as to whether he had assumed hair-powder to keep up his dignity, he shook his head, and replied, "No, sir, but I never slept for more than a quarter of an hour at a time, without jumping out of my berth, fancying that those Italian chaps had let the water get low, and perhaps that's turned my hair grey." For such a case, we fear, there is no remedy, for, with the best apparatus, some men will be careless; but, at any rate, we cannot do wrong to give them the best means in our power of detecting the danger. Glass water-gauges were a great step in advance of gauge-cocks, but they have disadvantages peculiar to themselves. The glasses break, or the passages choke up and deceive the engineer as to the true water-level. In boilers of large size, too, the glass is too high up to be conveniently seen; and, above all, at night time, mistakes are liable to be made. The percussion water-gauge obviates all these difficulties by having no parts liable to be broken or to choke up, and appealing as it does to the sense of feeling, can hardly be mistaken, even by the most obtuse. As shown in the engraving, it consists of a small cylinder of cast iron, some four or five inches diameter, connected to the boiler by two pipes, *a* and *b*, which are led, the former into the steam, and the latter into the water, where it is not likely to be influenced by currents. These pipes are not absolutely necessary, but in some cases the apparatus is not efficient without them. A free communication existing between the cylinder and boiler, the water-level will stand at the same height in each. In this cylinder, a piston, *c*, is fitted, attached to a piston-rod, passing through a stuffing-box in the top of the cylinder, and having connected to it a rod and handle, *d*, of such a length as to be within convenient reach of the engineer. In the piston are one or two holes, which effect a communication between the top and bottom of the cylinder. It is obvious that if the handle and piston be brought down smartly on the water in the cylinder, they will be arrested rather abruptly, when the piston reaches the water-level, and the position of the index, *e*, on the rod, will indicate the height of the water in the boiler. However much the water may prime in the boiler, the level in the gauge will be a fair average, and as each time the gauge is tried a portion of water will be driven through the lower pipe of communication, the latter will be thereby kept clear. We know that this gauge has met with universal success in the United States, and we predict for it a similar result in this country, so soon as its merits shall have become known.



MODERN IMPROVEMENTS IN FIRE-ARMS.

(Concluded from p. 95.)

The projectile force of gunpowder depends upon the evolution of various gases, the volume of which, at the moment of explosion, cannot be accurately determined. A cubic inch of powder is converted by ignition into about 250 cubic inches of *permanent* gases, which, according to Dr. Hutton, are increased in volume eight times, at the moment of formation, by the expansive influence of heat. At this rate, ignited powder (says Dr. Scoffern), will exert at least a force of 2,000 lbs. on every square inch! Good powder should be rather brown than black; the grains should be firm, not crushing by the pressure of the finger, not clotted together, and totally devoid of smell.

The disagreeable smell which sometimes arises from bad powder, is caused by the employment of too great a heat in fusing the nitre. This decomposes it partially, and the nitrate of potash, re-acting on the sulphur, forms sulphuret of potassium, and this in its turn re-acting on aqueous moisture, yields hydro-sulphuric acid gas, to which the disagreeable odour is attributable. The simplest plan of analysing powder (as to the relative proportions of its true ingredients), is by first dissolving out the nitre by means of pure water, then the sulphur by aid of a solution of potash, thus isolating the charcoal. Each of these substances, when dry, may be weighed. Dr. Scoffern takes some pains to expose the fallacious idea which many persons have entertained, who propose to attain a greatly increased range for projectiles by the employment of fulminating compounds more powerful than ordinary gunpowder. An ounce of powder, fired loosely, makes scarcely any noise, but in a musket would be a much larger charge than would be requisite for an ordinary ball. An ounce of fulminating silver, on the other hand—nay, but who would dare to handle an ounce of such a substance?—say, the *ninety-sixth part of an ounce*, or five grains; well, five grains of fulminating silver are taken out of a paper, with much trembling, touched with no hard substance, for fear of an explosion, then gently laid upon a piece of metal, say a penny piece; then suppose it ignited, by means of a very long stick, with a match at one end, and—begging the operator's pardon—with a somewhat rash man at the other; what is the result? A terrible crash, which deafens the operator for some days, and the penny piece is almost bent double! "How strong!" exclaims the non-chemical operator, "how well this will project a ball!" He tries a small charge in a musket, and what are the results? The gun is burst, the iron literally rent into threads and fragments, the ball perhaps *is* projected, but to a very inconsiderable distance; if of lead, flattened, as if by a hammer; if of cast-iron, *broken into fragments!* Now, which shall we say is the stronger substance, gunpowder or fulminating silver? It will be obvious, therefore, that the projectile value of a substance depends not only on the intensity of the explosion or suddenness of the liberation of the gases, but on its duration.

Dr. Scoffern shows the difficulty of accomplishing those extreme ranges, which have been proposed, if sufficient momentum is to be obtained by an initial impulse. The resistance of the atmosphere increases so rapidly with the velocity of the ball, that a point is soon arrived at, beyond which no force will increase the velocity. The author therefore suggests that, as far as we know at present, the only path open is the employment of a shell and rocket combined, the latter

being lighted after the former has arrived at its extreme range, by which means the rocket could be carried to a still greater distance.

Another difficulty, however, arises—the impossibility of directing such projectiles with any degree of accuracy. Take the case of a common musket, the path of a ball fired from which, does not merely vary in the same proportion as its distance from the barrel increases, but is excessively irregular after the first 50 yards of its flight. The remedy of rifling the barrel, which answers so admirably for small arms, is beset with difficulties when applied to large guns. The expense of lead as a material for expansive bullets on the Delvigne system (vide p. 76) renders it inadmissible. Breech loading guns, although Sweden contributed a splendid specimen to the Exhibition, are not to be depended on if of cast iron, and would be very expensive if of wrought iron. Experiments have been made at Woolwich with feathered shot, which can be thrust by hand down the mouth of the gun; but although the results gave hopes of ultimate success, they have not, we believe, been officially reported. Mr. Lancaster has, indeed, struck out in a new path, by making the bore oval and twisted, on the rifle principle. Of this plan, which is, at least, very ingenious, no experience has been yet had, except by the inventor.

Rockets have scarcely as yet assumed the importance which they are likely to do in the event of any European war, where, from the proximity of the scene of operations, criticism would be more vigilant. In our war with China, rockets were found most efficacious in setting fire to, and exploding the war junks, and whilst we are writing, they may be setting Rangoon in flames. The construction of the Congreve rocket differs from the ordinary rocket in the case being made of sheet iron, and the stick being placed centrically with the case, the discharge issuing through the annular space around the stick. Rockets may be fired from a tube, when accuracy of aim is a desideratum, or they may be merely laid on the ground and fired, when directed against a body of troops. In any case, their erratic and fiery course carries destruction with it, and no horse, however disciplined, will stand the hissing of a rocket. Sir W. Congreve, indeed, imagined that their portability, freedom from recoil and rapidity of discharge, would cause them almost to supersede artillery altogether. The weight of a 12-pounder gun is 18 cwt., while that of a 12-pounder rocket tube, which projects the same weight of ammunition, and at least to the same distance, is only 20 pounds. The freedom from recoil is an important advantage, as it permits of their being fired from a boat, where a heavy gun would be inadmissible. In field operations, six, twelve and eighteen pounder rockets are usually employed, but they are made as large as 300-pounders, nor does there appear any limit to their size. The chief objection to their use is the trouble which the stick occasions, and even this difficulty appears to have been completely obviated by Mr. Hale, who causes the gases evolved to be emitted in such a way that the rocket assumes a rotatory motion, like that of a rifle ball. The precise means employed are kept secret, but have been communicated to the American, Swiss, French and Russian governments. A single 10-pounder rocket was fired at Woolwich by Mr. Hale, on March 30th, 1849, from a wrought-iron tube, moving on a cast-iron stand. The rocket, being discharged at an angle of 20 degrees, without previously grazing, penetrated $10\frac{1}{2}$ feet into wet, close, loamy soil, at the distance of 1,733 yards, which is scarcely less than the effect of a 12-pounder shot at the same distance.

Mr. Hale has introduced an improvement also in the manufacture, by forcing the material into the case by a hydraulic press, instead of by ramming, as ordinarily practised. In the firing of his rockets, also, Mr. Hale has introduced a new principle, by confining them in their tube, or on their rest, until they have acquired a certain predetermined initial force. Thus, for a 10-pound rocket, Dr. Scoffern says, the inventor uses a repressive force of 6 pounds, which the rocket has to overcome, before it can commence its flight. The advantage of this contrivance is evident. As ordinarily fired, as soon as the inertia and friction are overcome, the rocket rushes forth into the air, but in consequence of a deficiency of initial velocity, it droops on first emerging from the tube, and thus loses its accuracy of flight. Mr. Hale's plan prevents this.

IMPROVEMENTS IN BULLETS AND BULLET MOULDS.

A NEW bullet, destined possibly to supersede the necessity of rifling guns, has been invented by Captain M. A. Maher. The bullet is shaped in section like the Delvigne or Minié, but dispenses with the use of the cap. The powder entering the hollow in its base, expands the lead sufficiently to attain all purposes. But its chief feature is, that the ball is itself rifled—if we may be allowed to use the expression—instead of the barrel, as shown in the subjoined sketches, fig. 1 being an elevation, and fig. 2 a plan. The upper portion is quatrefoiled or divided into four curvilinear parts or quarters, each quarter being slightly raised to the left, and depressed on the right, the line of division from the apex to the circumference assuming a slightly hyperbolic direction. The lower or cylindrical portion of the bullet, instead of being grooved into a series of parallel rings as of late, is made with a single groove passed round spirally, like the thread of a screw.

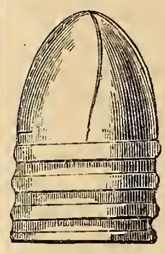


Fig. 1.

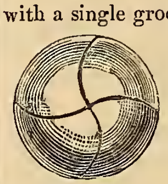


Fig. 2.

The combination of the raised hyperbolic projections round the apex, and the spiral screw of the lower cylindrical portion, adds materially to the rapidity of the rotatory motion obtained while passing through the air—which necessarily ensures increased precision in the line of direction being realized. The invention has been secured under the name of the "Mars" bullet, and we hope shortly to be able to lay before our readers a detailed account of the results of the experiments that are being carried on, as compared with trials with the ordinary Minié bullet. We need scarcely remark that its adaptation to ordinary fire-arms is not the least valuable recommendation of this invention.

We now proceed to explain the latest improvements which have taken place in the construction of moulds. The rapidity of the means of manufacturing bullets was somewhat impeded in consequence of their being apt to stick to one or the other of the "halves" of the mould, until the invention of the "Campion" mould lately registered. To the axle or centre of motion of the handles is affixed a metal plate, the upper surface of which supports the spill, and works in the same plane as that of the lower sides of the "halves," so that when the mould is closed, a precise adjustment of the spill takes place. A pin projecting from the lower arm of the mould, catches in one of two projections on the metal plates, and separates it from the halves, and with it the bullet carried by the spill. The only points of this design which are not new are the additional plate which supports the spill, and the projections above mentioned.

Except in the case of the Beckwith mould (*ante* p. 76), and one or two others, the lead is generally introduced at the apex of the bullet; and, as in the "Mars" bullet, that happens to form the more important part of its configuration, it became necessary, in order to provide a mould for its manufacture, to substitute some fitter mode of effecting the casting. Another serious objection raised against moulds of the ordinary construction, is that the air being allowed no other escape than the aperture at which the lead is introduced, expansion by heat and compression by pressure, act as antagonistic forces within the cavity of the mould, producing beds of lead in layers, flaws, and often

air-holes, which materially alter the dynamical centre of the mass cast. A perfect geometrical outline and perfect solidity are indispensable characteristics of a good bullet.

In order to remedy these evils, several improvements have heen introduced in the "Mars Bullet Mould," designed for Captain Maher by F. P. Rovère, C. E., and shown in the subjoined illustrations.

Fig. 3 is an elevation with the front half removed to show the internal arrangement; and fig. 4 a plan with the halves closed. These are formed with the apex of the mould placed downward, the lower side of the cutter working on the plane of the bullet *opposed* to the direction of its motion through the atmosphere. The cone is affixed to the cutter, and the plate of the Campion mould altogether dispensed with. The cutter is provided with two perforations, the one for the admission of the lead, and the other for the escape of the air. By means of the har and slot working on the axis of motion of the handles, and two small radius bars shown in the plan, the angle formed by the opening of the halves is bisected by the vertical plane passing through the slot and centre of the spill and cutters. By simply opening the haudles, the bullet not only disengages itself from the halves, but drops hy its own gravity into a box or other receptacle placed to receive it, without the mould having to he inverted as of old. The chief advantages of the arrangement are these:—The air being allowed an escape, the hullet can he cast perfectly solid; and, in the next place, the whole of the surface of the bullet which has to encounter any resistance from the atmosphere is left perfect, no portion whatsoever, of its curvilineal surface, having to he cut off by the cutter.

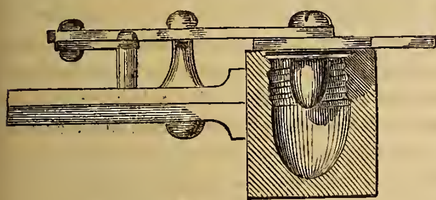


Fig. 3.

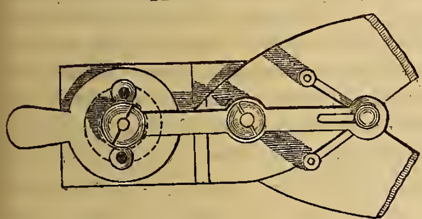


Fig. 4.

BEET SUGAR MANUFACTURE.

WITH PLANS OF SUGAR WORKS, AS CONSTRUCTED BY M. DEWILDE, ENGINEER.

Translated for *The Artizan* from the French of M. Armengaud Ainé.

(Illustrated by Plates 11 and 12).

The interest which the introduction of the manufacture of heet sugar into the sister kingdom has created amongst that large and important class who are dependent more immediately upon the cultivation of the soil, has induced us to undertake the collection of information on this subject. In France and Belgium this manufacture has made considerable progress, and it is to them that we must look for instruction. In the following paper it is necessary to remark, that we have aimed at giving the spirit, rather than a literal translation.

Much prejudice has existed, and still exerts a considerahle influence, on the suhject of heet-root sugar. It is generally supposed to he lighter, less sweet, and less wholesome than the sugar extracted from the cane. These are errors which it is important to eradicate.

The celebrated Chaptal has said on this subject, "Sugars extracted from different plants are identical in their nature, and differ in no respect when they are carried hy refining to the same degree of purity. The flavour, crystallization, colour, and weight, are identically the same; and any man, however well accustomed to judge or to consume these products, may be defied to distinguish one from another."—(Chaptal—*Chimie appliquée à l'Agriculture.*)

No industry has given, in so short a time, results to he compared with those of the home sugar manufacture.

It was in 1747, says M. Girardin, in his *Traité de Chimie Elementaire*, that Margraff, of Berlin, discovered in the beet root a crystallizable sugar, identical with that of the cane. The Baron Koppi, and Achard, of Berlin, were the first who, forty years afterwards, endeavoured to apply this discovery of the laboratory in practice. It was not, however, in France, until 1810, when Napoleon lent it his powerful aid, that this idea, pregnant with such important results, was realized by them. After uumerous vicissitudes, the extraction of home-grown sugar has hecome a most important branch of industry, since, in 1837, there were more than 500 establishments, producing upwards of 50 millions of kilogrammes. At the present time, in spite of the shackles of the excise, there exist no less than 400 factories, producing from 35 to 40 millions of kilogrammes of sugar, which complete, with the produce of our colonies, the quantity necessary for home use, viz., from 120 to 130 millions of kilogrammes.

It is in the departments in the North of France, that this manufacture is concentrated, more particularly in l'Aisne, la Somme, le Pas de Calais, and le Nord. This last Department produces more than the other there collectively, and gives France one half of her home-grown sugar.

In 1811, beet sugar produced to the manufacturer 5 francs per kilogramme. At the present time it only costs from 90 centimes to 1 franc, and there is every prohability that the price will descend to 30 centimes the kilogramme.

The beet roots are ordinarily used immediately after the crop is taken up, the excess being preserved in pits or trenches, from 1 metre to 1½ metres in depth. The roots, after heing piled up, are covered with a thick coat of earth, ridged up, and drains are dug on each side of the trenches to lead off the rain.

In spite of the most minute precautions, the roots suffer more or less alteration, and the sugar produced diminishes both in quantity and quality as the season advances. One process only, says M. Dumas, can prevent this serious loss, and that is desiccation immediately after the crop is taken out of the ground.

Numerous attempts to accomplish this end have given hope that agriculture will, one day, enjoy the immense advantages which the manufacture of beet sugar has hitherto hut partially yielded, and when the desiccated beet, converted at a low cost by the cultivator, and brought into the market like grain, can he used at the time and place most suitable, and thereby reduce the price of sugar to the lowest possible figure.

Mr. Schutzenbach is the first person who has drawn puhlic attention to the desiccation of beet root, by founding at Carlsrube a factory for this purpose. His apparatus, which is on the large scale, is composed of a high and narrow chamher, furnished with a series of metal endless bands, forming "carriers," placed one over the other, and moving in the direction of the length of the chamber. They are arranged in such a manner that the material, after travelling along one band, falls on to the next lower one, and so on until it reaches the bottom. The beet root, cut into slices and distributed over the topmost band, and carried over the successive bands to the bottom, and meeting with an ascending current of hot air, is robbed of its humidity, and is delivered perfectly desiccated.

"The beet-roots, after being dried, are reduced to powder; this is converted iuto paste and diluted with double its weight of water, slightly acidulated with sulphuric acid. It is then submitted to the action of a press, to obtain the juice as little turbid and discoloured as possible. This juice is then neutralized with lime, boiled and refined in the or-

dinary way. M. Schutzenbach says, that they thus obtain 9 per cent. of crystallized sugar.

This process has hardly been adopted to the extent that it appears to deserve; nevertheless, in Bavaria, Wurtemburgh, and Baden, there are some large establishments which make use of it, and with further improvements made in it by M. Jordan.

M. De Lirac, proprietor at Sarriannes, employs the heat of the sun to effect the desiccation with more economy. The slices of beet-root are sprinkled with lime, and exposed to the heat of the sun, from 10 hours' exposure to which they lose 70 per cent. of their weight. It is evident that it is only in the summer that this method is available.

M. Forbin Janson, of Avignon, proposed, in 1840, a process consisting in sprinkling the slices of beet-root, in proportion as they are cut, with animal charcoal, vegetable or mineral, reduced to a fine powder. This substance contributes to preserve the beet-root from all alteration, occasioned at first by the contact of the air with the juice issuing from the cells, in proportion as they are cut by the slicing apparatus, and later, by the humidity which the dried roots absorb in great abundance from the atmosphere. It contributes also to render the process of extraction of the sugar more easy, during the maceration, by drawing out the saccharine particles contained in the cells. Above all, it quickens the desiccation of the beet-roots in the sun, and gives in this way to the manufacturer, a process which unites all the advantages that can be desired. The proportion to be observed in the use of charcoal is, two to three parts of charcoal, according to the quality, to 100 of fresh beet.

DETAILS OF SUGAR MANUFACTURE.

The extraction of the saccharine matter from the beet, and its conversion into the refined sugar of commerce, form a series of operations, which may be enumerated as follows :—

Treatment of the Beet-root.—1, washing; 2, rasping; 3, squeezing. This last operation is replaced in some of our factories, by processes bearing the titles of maceration, levigation or lixiviation; that is, in a word, the extraction, strictly speaking, and the preliminary treatment of the saccharine juice.

Treatment of the juice.—1, defecation; 2, first filtration; 3, first evaporation; 4, second filtration; 5, boiling; 6, crystallization; 7, the filling, and minor completing details.

We shall describe each of these processes in detail, in analysing the the plans of a complete sugar works, shown in plates 11 and 12.

(To be continued).

NOTES BY A PRACTICAL CHEMIST.

New Test for Ultramarine.—Dilute 1 part sulphuric acid with 20 parts of water. Weigh off equal quantities (from 50 to 100 grains) of the samples to be compared, and place each in a separate glass. Add acid until the blue colour becomes red, and no blue particles are visible. The quantity of sulphuric acid consumed shows the degree of colouring power, and may be ascertained either by weighing or by means of a graduated pourette. If smalt be present, the blue colour is not completely destroyed. If the effervescence is violent, the presence of carbonates may be suspected, and the gases given off tested for carbonic acid.

New Test for Indigo.—The process requires—1. *A solution of sulphite of soda.* 100 parts crystallized carbonate of soda are dissolved in 500 parts water, and saturated with the sulphurous acid prepared from 100 parts copper and 400 parts of sulphuric acid.

2. *A solution of chlorate of potassa.*—4 grms. dry chlorate potassa are dissolved in as much water as will make up 400 cubic centimètres (6,177 grs. Troy).

3. *The solution of indigo.*—1 grm. finely ground indigo is dissolved in 10 grms. fuming sulphuric acid, and diluted to fill 200 cubic centim. In applying the test, 50 cubic centimètres of the indigo solution are measured off with a pipette, poured into a porcelain dish, diluted with 200 cubic centim. water, and heated to about 122° Fah., then mixed with 50 cubic centim. of the solution of the sulphite, and finally the solution of chlorate, dropped in by means of a pourette, until all the colour is destroyed. In order to judge how the process is going on, the mixture is tested from time to time by a strip of paper, whose colour may be observed, when held to the light. The last drops must be added very cautiously, allowing them to run down the sides of the dish. A second experiment should be made with another 50 centimètres, to check the result.

Prevention of Incrustations in Steam-boilers.—M. Delandre states that he has succeeded in preserving tubular boilers free from incrustation, by placing 2 lbs. protochloride of tin in a boiler which works 12 hours daily with a pressure of 3 atmospheres, consuming in this time 1,500 to 1,600 quarts of water, and is only emptied and refilled once in eight days. For steam-boilers which are emptied daily, and are of great power, the consumption of protochloride should be calculated at half a pound for every cubic mètre of water evaporated. The protochloride of tin is changed by the water into an insoluble basic and a soluble acid salt; the latter dissolves the earthy and calcareous salts.

Manufacture of Gas from Wood.—Two years ago Dr. Pettenkofer showed by experiment that a considerable amount of illuminating gas could be obtained from 2 ounces of wood. The practicability of the process on a large scale was then much doubted. It is now, however, in operation at Basel, and is about to be introduced at Zurich, Stockholm, and Drontheim. The process is said to be far less expensive than the manufacture from coal, and furnishes a gas free from sulphuretted hydrogen, besides several useful by-products, such as charcoal, wood-tar, and vinegar.

Notes on Caoutchouc and Gutta Percha.—M. Payen has made an examination of the various kinds of caoutchouc and gutta percha occurring in commerce. The following are some of his results :—

The kinds distinguished in commerce are :—1. White, opaque caoutchouc, in masses more or less bulky. 2. In irregular sheets or laminæ, at times transparent and yellowish. 3. Another sort in thick plates, or round (hollow or solid) brownish-grey opaque masses. 4. Brown caoutchouc, of the same shape, semi-transparent and yellow, when in thin plates.

Internal Texture.—In thin laminæ, numerous pores are observed under the microscope, which by capillary attraction absorb liquids in which the mass is insoluble.

Action of Water.—Thin slices of dry caoutchouc of the best quality, absorbed in a month from 18·7 to 26·4 per cent. of water. The former increased in volume 5, the latter 15·75 per cent. In a very long time, thick caoutchouc also imbibes water, and dries again very slowly. The quantity of water thus present should be noticed in commerce, since the actual value of the article may thus be decreased as much as 26 per cent. A white colour, as mark of superior quality, is totally fallacious. Besides, the absorbed water diminishes the tenacity and ductility of the caoutchouc. Threads and straps of caoutchouc, heated to 60°—70° Fah., and cooled to 32°, remain stiff and extended, even at common temperatures, but contract at once and become elastic, when heated to 95°—104° Fah. The whiteness and opacity of caoutchouc are caused almost entirely by absorbed water, for, on drying, it becomes brown and transparent.

Absolute alcohol penetrates caoutchouc, especially when heated to 172° Fah. Thin, transparent slices, repeatedly digested in alcohol, became

opaque within eight days. They grew adhesive, and increased in bulk and weight, although the spirit had extracted 21-thousandth of a yellow, fusible, fatty matter. After removal of the alcohol, the portions of caoutchouc were more transparent and adhesive than before.

Action of Solvents.—Ether, benzine, oil of turpentine, and sulphuret of carbon are rapidly absorbed by the caoutchouc, which they swell out and apparently dissolve. But this seeming solution is simply the consequence of a dissolved portion being deposited in the pores of the remainder, which is thus distended and rendered friable. If the solvent be added in excess, these two portions may be almost entirely separated. The properties of both portions are found altered, upon evaporation of the solvent. Pure ether extracts from caoutchouc 66 per cent. of an amber colour, leaving 34 per cent. of a brown. Rectified oil of turpentiue extracts from brown caoutchouc 49 per cent of an amber colour, leaving a brown insoluble matter to the extent of 51 per cent. In pure oil of petroleum, although a portion dissolves, the remainder swells out to 30 times its former bulk.

The best solvent is a mixture of 100 parts of sulphuret of carbon with 6-8 parts of alcohol, free from water. The caoutchouc liquifies rapidly, producing a clear solution, from which it may be again precipitated by the addition of twice its bulk of absolute alcohol, whilst the fatty and colouring matters remain in solution. The precipitate, treated with a fresh quantity of sulphuret of carbon, re-dissolves, yielding a more perfect solution. In the admirable process of Gérard, for spinning caoutchouc, a paste is obtained, by treating the caoutchouc with a mixture of 95 parts of sulphuret of carbon with 5 of ordinary alcohol containing 15 per cent. of water. He has further observed, that threads of caoutchouc, which may be stretched to six times their length, may be elongated six times more, after exposure to a temperature of 212°. The caoutchouc of commerce contains the following substances, in various proportions: 1, readily soluble, ductile, adhesive matter; 2, sparingly soluble, highly tenacious, elastic, extensile matter; 3, fatty matter; 4, volatile oil; 5, colouring matter; 6, nitrogenized matters; and, lastly, water up to 26 per cent. No one of these ingredients singly possess the elasticity and extensibility of the entire mass.

Gutta percha is separated by the same solvents into 2 parts; the one soluble and colourless, the other insoluble and coloured. Sulphuret of carbon, with the addition of 6-8 per cent. absolute alcohol, is the best solvent.

Direct Production of the Hydracids by means of Porous Bodies.—H. Correnwinder, by means of porous bodies, (spongy platinum and pumice stone) has succeeded in generating the hydracids from the direct contact of their components. Thus he has obtained very pure hydriodic acid, by passing, at a moderate heat, dry hydrogen gas over platinum sponge, which has absorbed the vapour of iodine. Hydrobromic acid is thus formed with still greater readiness, and hydro-sulphuric and hydro-selenic acids by substituting pumice stone for platinum. In these bodies there exists a cheap and powerful source of force which will doubtless ere long find extensive application in manufactures.

Estimation of Iron by means of a Colorimeter.—Mr. T. J. Herapath proposes the following method, applicable especially to the examination of mineral waters:—A standard solution of perchloride of iron, containing a little less than $\frac{1}{100}$ grain metallic iron, per cent., is prepared by dissolving 1 grain iron in hydrochloric acid with the addition of a little nitric acid, evaporating nearly to dryness, and diluting to 10,000 grain measures with distilled water at 60°; and from this, other standard solutions of different strengths were formed. A suitable quantity of the water in question, generally half a gallon, was evaporated to dryness, and the residue dissolved in hydrochloric acid. The iron contained in the solution having been peroxidized by boiling with a few drops of nitric acid, the silica and other insoluble matter were separated by filtration, and the peroxide of iron precipitated with ammonia. The latter precipitate was collected on a filter, and well washed with water; then re-dissolved in the smallest possible quantity of hydrochloric acid, and the liquid being placed in a tube or phial of known capacity, was diluted with pure water until it reached a mark on the side indicating 1000 water grain measures, a few drops of sulphocyanide of potassium having been previously added. The depth of tint was compared with that of the standard solutions above mentioned contained in tubes of similar diameter, in which known quantities of iron from the $\frac{1}{1000}$ to the $\frac{1}{4}$ of a grain were contained in the same bulk of water. In order to render the comparison of the tints more perfect, the tubes were placed against a sheet of white paper, and held between the eye and a diffused light. In this manner the author was able to estimate $\frac{1}{1000}$ grain of iron per gallon with readiness. It was sometimes found preferable to employ but one standard solution. The proportion of iron in the liquid tested was then determined by measuring the volume of water that was required to lighten the tint, so as to render it identical with that of the normal solution, or *vice versâ.*

ANSWERS TO CORRESPONDENTS.

"E. Vivian." We cannot again enter into the washing powder controversy, more especially as you have no new argument to bring forward. We extend our challenge to you also; forward your sample, and if it fulfils the conditions requisite, we will gladly own ourselves mistaken.

"22, Birmingham." The patent to which you allude actually proposes to convert uric acid into oxalic, although the former is by far the more valuable of the two. We should be very glad of a method for converting oxalic into uric.

"A Calico Printer." The colouring principles of insects, though they infinitely surpass all others in beauty, have, with the exception of cochineal, not been as yet found available. From our own experiments, we have been led to doubt the probability of their being soon rendered of any practical value. The pigments are exceedingly small in quantity, and difficult, for the most part, to extract unchanged. Many of the most exquisite colours, moreover, seem to depend rather upon the mechanical structure of the surface than upon any peculiar tinctorial principle. If our correspondent has time and inclination, we would suggest to him to experiment upon the family of beetles known to naturalists under the name Chrysomelidæ, and especially the genus Timarcha.

S.

MOON'S PATENT HOLLOW CHIMNEY BRICKS.

(Illustrated by Plate 9.)

Since the removal of the blighting influence of the Excise laws, brick-making seems likely to be raised to the dignity of a science, if we may judge from the amount of ingenuity expended in devising new modifications of not merely bricks, but every description of fictile manufacture. We have a stock of articles to notice, as soon as we can find room for them, amongst which we select, on the present occasion, Moon's hollow chimney-bricks. The barbarous method of building chimney-shafts, as handed down from generation to generation, is well known. The rectangular form, to begin with, is wrong in principle, and the system of lining them with plaster is one of the most dangerous and insidious sources of fire that we are acquainted with. The pargetting is raked out, in cleaning the chimney, the mortar falls out of the joints, and the smoke insinuates itself, as it has a most extraordinary tendency to do, into all the crevices behind the woodwork of the rooms, lying drying, until it becomes as susceptible of ignition as gunpowder. In the house which the writer of these lines has the misfortune to tenant, the smoke issues from the crevices round the skirting, in both dining and drawing rooms, to the manifest injury of the furniture, and the destruction of the peace of mind of the occupier. For these evils, Mr. Moon's arrangement offers a satisfactory remedy. All cutting of the bricks, and pargetting, is saved, and a perfectly smooth and cylindrical interior to the chimney is obtained. From their hollow form, 500 of these bricks will do as much work as 1,000 of the ordinary form. The plate shows all the arrangements so clearly, that further description is almost needless. The inventor suggests that the bricks for the external shafts may be also used for building piers or pillars, and, set upright, as blocks for cornices. The dies are manufactured by Mr. Clayton, of the Atlas Works.

STATISTICS OF LOWELL MANUFACTURES.

JANUARY, 1852.

COMPILED FROM AUTHENTIC SOURCES.

CORPORATIONS.........	Merrimack Manufacturing Company.	Hamilton Manufacturing Company.	Appleton Company.	Lowell Manufacturing Company.	Middlesex Company.	Suffolk Manufac'ng. Company.	Tremont Mills.	Lawrence Manufacturing Company.	Lowell Bleachery.	Boott Cotton Mills.	Massachusetts Cotton Mills.	Lowell Machine Shop.	TOTAL.
Incorporated	1822	1825	1828	1828	1830	1830	1830	1830	1832	1835	1839	1845	....
Commenced Operations...	1823	1825	1828	1828	1830	1832	1832	1833 & 1834	1832	1836	1840	1845	....
Capital Stock, dollars ...	2,500,000	1,200,000	600,000	1,500,000	1,000,000	600,000	600,000	1,500,000	300,000	1,200,000	1,800,000	600,000	13,362,400
Number of Mills...........	6 & Print-Wks.	4 & Print-Wks.	3	1 Spinning. 1 Carpet. 1 Cotton.	4 & 3 Dyehouses.	3	2	5	Bleachery and Dye-Works.	5	6	2 Shops, Smithy & Foundry.	50
Spindles.......................	70,720	45,232	17,920	4,200 Wool. 7,142 Cotton.	16,340	17,528	16,608	44,800	....	49,434	45,720	....	325,500
Looms	2,108	1,324	600	222 Cotton. 121 Power Carpet. 30 Fancy Check.	75 Broadcloth. 328 Cassimere.	590	557	1,382	....	1,432	1,556	....	9,906
Females employed	1,614	950	400	650	730	400	400	1,200	20	870	1,250	....	8,274
Males employed	645	350	120	450	575	100	100	200	250	262, including mule tenders.	250	700	3,702
Yards made, per week ...	385,000	240,000	150,000	8,000 P. Stuffs. 16,000 yds. Carpet. 100 Rugs. 95,000 yds. Cotton.	16,587 Cassimere. 3,890 Broadcloth.	120,000	140,000	260,000	....	300,000	475,000	....	2,190,000 Cotton. 20,477 Wol'n, 15,000 Carpets, 40 Rugs.
Cotton consumed, per week, pounds	83,000	70,000	60,000	50,000	....	48,000	42,000	95,000	....	90,000	150,000	4,500 tons wro't and cast iron per ann.	575,400
Wool consumed, per week, pounds	....	....	....	36,000	33,000	....	....	....	....	....	....	....	69,000
Yards dyed and printed .	330,000	100,000 Printed. 36,000 Dyed.	....	....	....	....	....	....	15,000,000 yds. dyed per annum	....	....		394,000 Printed. 9,515,000 Dyed.
Kind of goods made	Prints & Sheetings, No. 22 to 40.	Prints, Flannels and Sheetings, 14 to 40.	Sheetings and Shirtings, No. 14.	Carpets, Rugs, Cotton Cloth, and Pantaloon Stuffs.	Broadcloth. Cassimere. Plain and Fancy.	Drillings, 14.	Sheetings, No. 14. Shirtings, No. 14.	Printing Cloths. Sheetings & Shirtings, 14 to 30.	5,000,000 lbs. bleached per an.	Drillings, No. 14. Sheetings, No. 30. Shirtings, No. 30.	Sheetings, No. 13 Shirtings, No. 14 Drillings, No. 14	Cot. & Wool'n. M'y. Locomotives and Steam Engines. Machinists' Tools, & Mill-work.	....
Tons Anthracite Coal, per annum	7,500	3,780	350	2,600	4,000	340	350	1,000	4,000	1,300	2,700	1,500 tons hard. 300 chal. soft.	28,220
Charcoal, bushels, per ann	3,555	2,148	1,000	2,000	2,000	1,600	900	3,000	....	1,800	2,000	15,000	25,003
Wood, per annum, cords	400	200	....	....	700	30	50	120	300	70	100	100	2,270
Oil, per annum, gallons...	7,260	6,000	4,000	Lard, 12,000. Sperm, 5,000.	Lard, 27,000. Sperm, 8,000.	2,500	3,600	8,217	2,000	7,000	12,000	3,000	68,517 Oil. 39,000 Lard.
Water-wheels, diameter .	Breast, 30 feet. Turbine, 5 feet.	6 Turbines. 3 Breast wheels.	2 Turbine, each 8 ft. 4 inches in diameter. 1 do., 5 feet 8 inches.	Turbines.	12 & 17 feet.	13 feet.	2 Turbines.	17 feet.	....	17 feet, and 2 Centre Vent Wheels, as improved by Mr. Francis, 9 ft. 4 in. diam'r.	17 feet. 2 Turbines.	13 feet.	....
Length of do for each Mill	Breast, 24 feet.	....	....	....	23, 21 & 45 feet.	42 feet.	....	60 and 80 feet.	....	60 feet.	60 feet.	46 feet in all.	....
Starch, lbs., per annum ...	205,000	140,000	75,000	....	....	100,000	75,000	140,000	275,000	190,000	220,000	....	1,395,000
Flour, barrels, per annum	750	200	....	....	....	....	50	....	600	....	40	....	1,640
How warmed	Steam.	Steam.	Steam.	Steam.	Furn. & Steam.	Steam.	Steam.	Steam.	Steam.	Steam.	Steam.	Steam.	....
Name of Agent	Isaac Hinckley.	John Avery.	George Motley.	Alex. Wright.	W. T. Mann.	John Wright.	Chas. L. Tilden.	Wm. S. Southworth	C. A. Babcock.	Linus Child.	Josph. White.	Wm. A. Burke.	....

Average wages of Females, clear of board, per week Ds.2,00
Average wages of Males clear, of board, per day.............................. 0,80
Medium produce of a Loom, No. 14 yarn, yards, per day 45
Medium produce of a Loom, No. 30 yarn, yards, per day 33
Average, per Spindle, yards, per day 1⅓

The Middlesex Company make use annually of 6,000,000 Teasels, 1,716,000 lbs. Fine Wool, 80,000 lbs. Glue, 60,000 dols. worth Dye Stuffs, and 17,000 dols. worth of Soap. They also own the Wamesit Carpet Mill, on the Concord River, where are consumed, annually, 93,600 lbs. Coarse Wool, and 36,400 lbs. of Worsted Yarn, producing 91,000 yards Ingrain Carpeting.

In addition to the above, the Merrimack Manufacturing Company use 1,000,000 lbs. of Madder, 380,000 lbs. Copperas, 60,000 lbs. Alum, 50,000 lbs. Sumac, 40,000 lbs. Soap, 45,000 lbs. Indigo, per annum.

The Lowell Bleachery use 40,000 lbs. Indigo, and 25,000 dols. worth of other Dyeing Materials, per year.

Other manufactures are produced in the City than those specified above, of a value of 1,500,000 dols., employing a capital of 400,000 dols., and about 1,500 hands.

There are four Banks—The Lowell, capital 200,000 dols.—The Railroad, capital 600,000 dols.—The Appleton, capital 150,000 dols.—The Prescott, capital 100,000 dols.

The population of Lowell, in 1828 was 3,532—in 1840, it was 20,796—in 1850, it was 33,385. Increase, in ten years, 12,589.

The Lowell Machine Shop, included among the above Mills, can furnish Machinery complete for a Mill of 6,000 Spindles in three months, and a Mill can be built in the same time.

The several Manufacturing Companies have established a Hospital for the convenience and comfort of persons employed by them respectively, when sick, which is under the superintendence of one of the best of surgeons and physicians.

There are two Institutions for Savings—the Lowell and the City. The Lowell had, on deposit, the first Saturday in Nov. 1, 1850, from 4,609 depositors, Ds.736,628.12. The City, at the same time, had, on deposit from 615 depositors, Ds.75,970.51. The operatives in the Mills are the principal depositors in the above Banks.

A *Reservoir*, of great capacity, has been built on the high ground in Belvidere, east of the City, for the purpose of furnishing a ready supply of water to any part of the City, in cases of fire. The water is conveyed into the Reservoir by force pumps from the Lowell Machine Shop. Pipes are laid from the Reservoir to various parts of the City, at which points hose can be attached to the hydrants without delay, when necessary.

The preceding account of the Lowell Manufactures, with which we have been favoured by a correspondent, cannot but be interesting to our readers, who belong to the class either of consumers or producers of cotton goods.

REVIEWS.

The Practice of Embanking Lands from the Sea. By John Wiggins, F.G.S. London: Weale. Rudimentary Series.

There is probably no branch of civil engineering, if we except hydraulics, of which so little is known by the profession generally and the public, as the reclamation of land from the sea. It is in the eastern counties, north of the Thames, that the art has been most needed and practised, and it is precisely in those counties that the least commercial enterprize and activity have prevailed. The operations have been mostly conducted on the small scale, and have excited but little attention beyond the districts in which they took place. Indeed, so low an opinion have the midland counties formed of the East Anglians, that, at a recent lecture at the Society of Arts, Mr. Forbes attributed the removal of the woollen manufacture from Norwich to Bradford, to the want of energy on the part of the losers, in not adopting new machinery, instead of attributing it, as he ought to have done, we conceive, to a combination of causes, amongst which may be mentioned the difference in the price of fuel. However this may be, we are much obliged to Mr. Wiggins for his very sound and practical work, with the merits of which we must endeavour to make our readers acquainted.

In calculating the strength required for an embankment, it is obviously all but impossible to lay down any theoretical rules. Our author does so, but recommends (as has been done with some engineers' estimates) to double the result "in practice."

A sea bank* must, it is obvious, possess the following qualifications. It must be heavy enough to counterbalance the weight of the water it has to sustain; the materials must be sufficiently cohesive to withstand the erosive action of the waves; and to prevent leakage, the foundation must be stable and water-tight; and the height must be such, that the most extraordinary high tides, which may occur in connexion with particular winds, shall not be liable to overtop the bank.

Sand, as being the only material at hand, is often used for sea-banks, although it is never to be recommended, from its want of cohesion. At any rate, the bank must be of increased dimensions to compensate for its deficiency, and must be protected with stone, or clay and turf. After all, so insidious is the attack of the sea, in sucking out the loose sand and undermining the bank, that it is acknowledged that "no art nor expense whatever can always ensure a sea-bank on a sandy shore, and in an open exposed situation, from considerable damage."

Clay forms a good material, and the bank may be of diminished size, but the materials must be well combined. "Some banks have failed in consequence of the sods, even of clay, being loosely thrown together by means of planks and barrows, and mixed with loose earth, the water thus being enabled to percolate the earth, surrounded the sods, and rendered them almost buoyant, so that the whole mass separated and dispersed; whereas the loose earth ought to have been either collected under the pressure of carts and horses, or *rammed down hard with iron shod rammers*, and the sods placed carefully outside, to defend the most exposed part."

We believe that in these words in italics the whole art consists. Every one who has had any experience in foundation work, knows the value of ramming or "punning;" for example, no person, without previous experience, would believe what can be done by merely ramming loose material together in a wooden frame, as in *pisé* work. Practical hints on the subject of foundations will be found in 1848 vol., p.p. 198-222.

Stiff clay is commonly used in Essex for sea-banks, "taken from the saltings or oozy forelands, and is therefore in a wet state, and very ponderous. It is dug in spits, and packed into a sea-wall by a process called 'flood flanking;' the barrow-men delivering the spits to the packers, who take each spit on a pitchfork, and striking it hard into its place, it adheres closely; but as these spits contract in drying, the crevices outside are therefore filled with mud, which is called 'sludging.'" This leaves the centre open, which often causes leaks, &c.

At the first blush, the reader will probably be surprised to hear that "Peat is a good material, not only by reason of its stanching, but also its adhesive qualities when packed in a moist state, so as to form a tolerably homogeneous mass. Its defects are, lightness (requiring to be heavily weighted with stone), and aptitude to split in drying, forming crevices." "Peat is supposed to be liable to decay, and run into a black mould; but for this it requires atmospheric influence and changes; and in fact, a peat sea-bank, which was opened after being built 17 years, exhibited the material as fibrous and undecayed as when first deposited. It had been covered and compressed with from 1 to 3 feet of stone and gravel. This peat bank was built across a sandy estuary, where it was deemed too hazardous to make use of any portion of the sand, in the construction of the bank, the points aimed at being its fixation and compressure."

Stone has failed, as, although well cemented, it will never remain water-tight. A case of this kind occurred, on the large scale, at Tre Madoc, in Carnarvonshire.

Gravel, when on the spot, may be extensively used with advantage as a footing to the slope, forming an artificial beach, and a good road-way. It does not possess sufficient cohesion (in the author's opinion), to form the heart of the bank, but a coating may be applied before the stone facing is laid down. It is evident, however, that this is simply a question of a supply of material, because it is remarked, "A wall of *pisé*, or rammed gravel in a frame, might very judiciously be adopted for 2 or 3 feet of the centre of the bank;" and again, "Gravel might be substituted for stone or any other facing of the whole bank, and to qualify it for this valuable application, it is only requisite to give the bank sufficient slope, so as to resemble a natural sea beach; and if the original shore is muddy, a coating of 6 inches of gravel, over 18 inches of mud, would probably form a facing not to be surpassed." If gravel, therefore, will serve both for the heart and the facing of the bank, it leaves little else to be desired. Its use resolves itself into a question of labour *versus* materials; as Mr. Wiggins himself puts it, "Even soft wet mud, costing 3*d*. per cubic yard to throw up, may be fixed and consolidated into cement by the addition of one-third gravel brought to mix with it, costing 1*s*. per cubic yard, making the whole to average 6*d*. per cubic yard." In this way, materials on the spot, which might be rejected on account of their unpromising appearance, *when wet*, may be worked up to advantage. "On the other hand, some soils are extremely firm and even difficult to pick up in their present site, but when raised and exposed to atmospheric influence, resume the state in which they were first geologically deposited. Examples of this kind were frequent upon the construction of the Eastern Counties Railway, about Chelmsford, where the diluvial clays, upon exposure, again became mud."

The conclusion, then, that we wish to be drawn from our remarks, and the author's argument, is, that due attention should be paid to the perfect combination of the materials, as well as to the magnitude of the bank. A bank of moderate thickness, well laid, will be more to be relied on, and *cost less in repairs*, than any erection in which bulk is its only protection; nor must it be forgotten, in calculating the relative pecuniary advantages, that a saving in material, which has to be raised, even if not brought to the spot, will assist in paying for the labour requisite to ensure its cohesion.

(To be continued.)

* It appears correct to call a long slope a "sea-bank," as a nearly vertical erection of stone is called a "sea-wall."

Tables for Calculating Cuttings and Embankments, with Explanations and Examples. By James Henderson, C.E. 8vo., pp. 29. London: Simpkin and Co.

Tables generally do not admit of much criticism; their value is best tested by their lying on the office table. Mr. Henderson, however, has stated his "case" so pithily, that we cannot do better than allow him to state it in his own words.

"The principal feature in the construction of tables 1 and 2 consists in the application of a new formula for calculating the sides or pyramidal parts of cuttings and embankments. The formula at present generally in use is $\frac{1}{3}(a^2 + a\,b + b^2)$ L, a and b being the height or depth of cutting or embankment at each end, and L the length. The formula adopted for these tables is $(H^2 + \frac{1}{12}D^2)$ L, H being the mean height or depth, and D being the difference of heights or depths. In tables computed from the former formula, separate quantities require to be given for every variation of a and b; but with the latter, by the arrangements followed out, one quantity only is necessary for all heights or depths having the same mean, and one for all heights or depths having the same difference. These tables thus possess the advantage of being rendered very comprehensive within a very limited space, while they are at the same time extremely simple and easily applied to practice. To carry out a table for the pyramidal or side parts of cuttings and embankments, based on the old formula, for every tenth of a foot of height or depth, from one-tenth up to fifty feet, upwards of 125,000 different quantities are required, but, by means of the new formula, the whole can be comprised within 1,000."

It is only justice to Mr. Henderson to say, that the setting up of the tables, as to order and type, is such as to do him great credit.

Whilst on this subject, we will take the opportunity of unburdening our minds of a grievance. During the last few years, the stock of tables in our library has swollen to such dimensions, that it is often more trouble to find a particular column in a particular book, than it is to run out the result for one's self. *If they were only all of one size,* say octavo, they could be bound up with a MS. index, and their usefulness immensely increased. Could not the various authors of tables combine, and do something of this kind?

THE GREAT CENTRAL GAS COMPANY.

REPORT TO THE COMMON COUNCIL, BY DR. LETHEBY.

As our readers well know, we have taken great interest in the progress of the cheap gas movement; and it is, therefore, with much pleasure that we publish the report of so eminent a man as Dr. Letheby, which settles the question as to quality of the gas supplied to the City. We *know* the price.

Gentlemen,—Nearly three months have elapsed since I had the honour of being elected to the office of chemical referee under the act of the Great Central Gas Consumers' Company; and in accordance with the provisions of this act, and instructions which I have received from the Court of Common Council, I beg leave to present you with my first report of the illuminating power and chemical quality of the gas supplied to the city of London by the aforesaid Company.

This Court will, perhaps, remember that, in the 23rd section of the Company's act (14th and 15th Vict.), it is decreed, "That all the gas supplied by the Company shall be of such quality as to produce from an Argand burner, having 15 holes and a seven-inch chimney, and consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by 12 wax candles of six in the pound, burning 120 grains per hour; and such gas shall be superior in purity to the gas in common use at or about the 7th day of December, 1849, by any of the Companies who then lighted the city of London or any part thereof with gas."

From this, it is clear that the duties which I am called to perform are of a twofold nature—namely, first, to ascertain whether the illuminating power of the gas supplied by the Company is equal to the standard laid down in the act; and secondly, to determine whether the purity or chemical quality of the gas is or is not superior to that which was in common use in the city of London at or about the 7th day of December, 1849.

In order to determine the first of these points, I have, within the last three months, performed as many as 30 experiments on the illuminating power of the gas. These experiments have been conducted at various times during the day and night, and have also been made without the previous knowledge of the Company, or of any of its officers. I ought also to state that, for the purpose of guarding against every source of fallacy and error, I have taken the precaution to trace the pipe which supplies the gas to my laboratory to its origin in the Company's main; I have had my experimental meters subjected to the most rigid examination by your inspector, Mr. Taunton; I have used the best means for procuring wax candles of known purity, by purchasing them at two of the most respectable houses in the city of London, namely, at Mr. Batty's, on Finsbury-pavement, and Messrs. Cowan, of Mansion-house-street; I have employed the most delicate photometers; and, finally, I have taken care to record the details of my experiments in a volume which I have designed expressly for the purpose. I trust, therefore, that the Court will consider the following results to be as truthful and as complete as the circumstances of the case will permit:—

Out of the thirty experiments alluded to, I find that, on one occasion, the illuminating power of the Company's gas was as low as that of 13 standard wax candles; this, however, is one-twelfth higher than the intensity required by the act of Parliament. On every other occasion, it was considerably above this point, and in one instance it had actually reached to the intensity of 22·2 standard candles. To take the mean of all my experiments, it may be said that the average illuminating power of the gas, when burnt according to the act of Parliament directions, is equal to that of 17 wax candles, each burning at the rate of 120 grains per hour. From this it will be evident that the Company have, during the last three months, supplied to the city of London a gas of nearly one-half greater illuminating power than that specified in their act of Parliament.

Not content, however, with this mode of investigating the facts of the case, I have instituted another set of experiments, the results of which will enable the Court to form an estimate of the relative value of this gas as compared with other common illuminating agents. When the gas is burnt according to the act of Parliament directions, it gives a light equal to that of of 23 mould candles of six to the pound, each burning at the rate of 145 grains per hour; or that of 18 common oil lamps, each burning the best sperm oil at the rate of 133 grains per hour; or to that of 2·5 Argand lamps burning the same oil each at the rate of 450 grains per hour; or to that of 13 sperm candles of six to the pound, each burning at the rate of 133 grains per hour; or to that of 15 composition candles of six to the pound, each burning at the rate of 136 grains per hour.

Now, if we make an inquiry into the relative cost of these illuminating agents, we shall find that the facts thereof may be expressed as follows:—

The Company's gas, equal to	1
Sperm oil, burnt in an Argand	8
Mould tallow candles, of six to the pound	12
Sperm oil, burnt in an open lamp	17
Sperm candles, of six to the pound	24
Composition candles, of six to the pound	29
Wax candles, of six to the pound	30

In other words, by estimating the cost of the Company's gas at 4*s.* per 1,000 cubic feet, the price of mould candles at 6*d.* per lb., the value of sperm oil at 8*s.* per gallon, and the price of wax, sperm, and composition candles at 2*s.* per lb., it may be said a shilling's worth of the Company's gas will go as far in the production of light as 8*s.* worth of sperm oil burnt in an Argand lamp, or 12*s.* worth of ordinary mould candles, or 17*s.* worth of sperm oil burnt in an open lamp, or 24*s.* worth of sperm candles, or 29*s.* worth of composition candles, or 30*s.* worth of wax candles.

In concluding this part of my report, I take the opportunity of suggesting, that in my opinion it is advisable to make an alteration in the present mode of estimating the luminosity of the gas; and that, instead of employing a wax candle as the standard of comparison, it would be better to make use of a sperm candle which burns at the rate of 130 grains per hour, for I find

that the illuminating power and consumption of wax are much affected by accidental and uncontrollable circumstances. The consequence is, that the value of the light so produced is far from being a fixed and certain product, besides which, it is difficult, if not impossible, to obtain a commercial candle of the act of Parliament standard; for it will be found that, instead of burning at the rate of 120 grains per hour, their combustion is usually at the rate of from 170 to 180 grains. This difference complicates the results, and exposes them to the errors of false calculation.

With regard to the second part of my duty, I beg leave to say that I have submitted the gas to very careful examination, with the view of detecting two of the common impurities of coal gas, namely, ammonia and sulphuretted hydrogen, but I find that it is particularly free from these deleterious compounds. In this respect the gas is purer than that which was formerly supplied by the metropolitan companies. I speak from my own experience in the matter, for it happened that I was officially engaged, in the month of October, 1849, in testing the quality of the gas supplied by two of the companies to the city of London; and I have no hesitation whatever in saying that the gas furnished at the present time by the Great Central Gas Consumers' Company is superior, both in purity and in illuminating power, to that which I had the opportunity of examining three years ago.

A report has obtained currency that the gas which is supplied by the present Company is largely diluted with atmospheric air. Upon this point I would remark that, if such a condition of things actually existed, one of two consequences would infallibly result—either the gas would be reduced in illuminating power, or it would become explosive, and would not burn from the jets at all. That the former is not the case is evidenced by the results which I have just detailed, and that the latter is equally untrue is proved by the experience of every consumer.

In conclusion, I have the satisfaction of saying that the Company have afforded me every facility in the performance of my duties, and have given me unqualified power to purchase, at their expense, everything which I may require for experimental purposes. They have likewise placed at my disposal two rooms in their house in Coleman-street, one of which is fitted up in a very complete manner for photometrical experiments; and the other is to be fully stocked by Mr. Knight, of Foster-lane, with all the apparatus necessary for performing the most searching chemical investigations.

I have the honour to be, gentlemen, your faithful servant,

(Signed) H. LETHEBY.

London Hospital, May 10th, 1852.

THE U. S. SCREW PROPELLER STEAMSHIP OF WAR, *SAN JACINTO.*

By Chief Engineer B. F. Isherwood, U. S. Navy.

(Concluded from page 64.)

In using any propelling instrument for the transmission of power, a portion of that power is unavoidably lost in misapplication. In the common paddle wheel, this misapplication consists in giving a retrograde motion, in a direction parallel to the vessel, to the water acted on by the paddles, termed dip, and to a vertical depression and lifting of the water, termed oblique action—the total losses by the paddle wheel being the sum of the losses by slip and oblique action. In the screw there is the same loss by slip, but the loss by oblique action, which does not exist with the screw, is replaced by another, viz, that of the friction of the screw surface on the water. The total losses by the screw would then be the sum of the losses by slip and friction.

It has been ascertained by experiment, that the friction of solid surfaces on water, is directly as the surface and as the square of its velocity. In the same screw then, with equal velocities, the friction is as the surface; but the slip is by no means as the surface, but in a far less proportion, to be ascertained only by experiment.

The only reliable experiments made with this view, that I am in possession of, are those by Bourgeois, made by order of the French government; and one of them is nearly a parallel case to the originally proposed and actually executed screws of the *San Jacinto.*

Bourgeois tried a screw of six blades having a surface of $\frac{6}{7}$ths of the area of the diameter of the screw, viewed as a disk. The slip obtained was 37 per cent. Two of the blades were now omitted, and the remaining four placed equi-distant. The screw in this state was composed of 4 blades, having a surface of $\frac{4}{7}$ths of the area of the diameter, viewed as a disk; the slip was now found to be $38\frac{1}{10}$ per cent., or only $1\frac{1}{10}$ per cent more than before. This experiment was pushed still further by the reduction of another blade, leaving the screw composed of 3 blades, with a surface of $\frac{3}{7}$ths of the disk; the slip now obtained was $41\frac{8}{10}$ per cent., or only $4\frac{8}{10}$ per cent. more than the first slip; showing that a reduction in the surface of one-half, only increased the slip from 37 to $41\frac{8}{10}$ per cent., or $11\frac{1}{2}$ per cent. of the last slip.

Supposing, now, the screw as originally proposed for the *San Jacinto* had been used, having about $1\frac{3}{4}$ths the projected and $3\frac{1}{2}$ times the helicoidal surface of the one actually used; and supposing the increased projected surface had decreased the slip in the above proportion of $11\frac{1}{2}$ per cent., or $3\frac{2}{100}$ per cent. of the actual slip of the *San Jacinto's* screw: there would then have been obtained a slip of $(26\frac{27}{100}—3\frac{02}{100})$ $23\frac{1}{4}$ per cent. But the helicoidal surface having been increased $3\frac{1}{2}$ times, the friction would also have been increased in nearly that proportion; and as we see the friction with the present surface amounts to $6\frac{83}{100}$ per cent., it would have amounted with the $3\frac{1}{2}$ times surface to $23\frac{9}{10}$ per cent. Supposing the total power developed by the engine to have remained the same, in which case the available power for the propulsion of the vessel would have been diminished by $(23\frac{9}{10}—6\frac{83}{100})$ $17\frac{7}{100}$ per cent., and increased $3\frac{2}{100}$ per cent. by the lessened slip, leaving a balance of diminution of $(14\frac{7}{100}—3\frac{2}{100})$ $17\frac{5}{100}$ per cent. of the available power for propulsion; and as the speed of the vessel is in proportion to the cube roots of the powers applied, the speed would have been to the present speed in the proportion of $\sqrt[3]{1·000}$ to $\sqrt[3]{0·855}$; or, instead of being 11 statute miles per hour, would have been 10·44 statute miles per hour; always supposing the engines to develope the same power. The sum of the losses then of the proposed screw would have been $(23\frac{25}{100}+23\frac{9}{10})$ $47\frac{15}{100}$ per cent., instead of $33\frac{1}{10}$ per cent., the sum of the losses by the present screw. The present screw is therefore more economical by $14\frac{5}{100}$ per cent. of the power, without reckoning the practical advantages of decreased weight and cost of manufacture.

The screw proposed by the Board, and used on the *San Jacinto*, has not the proportions they would have adopted, had they been designing the entire machinery of the vessel; but the engines, boilers, and stern of the ship having been completed before their labours began, they had only to adopt the best screw that existing conditions permitted. A longer screw was impracticable, with the stern of the vessel as built, and the surface was limited in that direction; more than four blades of the same length would have given more surface, but that surface would have been nearly useless, as the blades would have been so close together as to prevent the access of water of sufficient solidity, besides having the additional resistance of the additional edges of the blades. Nor could increased surface be obtained by lessening the pitch; for such was the complex design of the engines, the multitude of its connections and moving parts, that it was unsafe to work them up to a speed that would be necessary, with a reduced pitch, to give the vessel the proper speed; in addition to which, the boilers would not have supplied steam enough for the increased number of revolutions.

Hull.—The *San Jacinto* is 203 feet long on keel, 210 feet long at load line, 215 feet long between perpendiculars, and 237 feet extreme length. The beam moulded is 37 feet, extreme 38 feet. Depth of hold $23\frac{1}{2}$ feet. Deep load draft $16\frac{3}{4}$ feet. Depth of keel and false keel 15 inches.

Displacement in tons of 2,240 lbs., at launching draft of $10\frac{1}{2}$ft., 1080.

			Tons.		lbs.
,, ,, ,,	$11\frac{1}{4}$ feet draft		1156	and	1764
,, ,, ,,	$13\frac{1}{4}$,,	..	1489	,,	1242
,, ,, ,,	$15\frac{1}{4}$,,	..	1838	,,	1658
,, ,, ,,	$17\frac{1}{4}$,,	..	2202	,,	2055
,, ,, ,,	$16\frac{3}{4}$,, (load draft)		2150		
,, ,, ,,	per in. of draft at load line		$17\frac{1}{3}$		

Area of immersed amidship section at	$11\frac{1}{2}$ feet draft	..	273·81 square ft.
,, ,, ,,	$13\frac{1}{4}$,,	..	346·55 ,,
,, ,, ,,	$15\frac{1}{4}$,,	..	420·05 ,,
,, ,, ,,	$17\frac{1}{4}$,,	..	496·05 ,,
,, ,, ,,	$16\frac{3}{4}$,,	..	477·05 ,,
,, ,, ,,	$15\frac{2}{3}$,,	..	438·56 ,,

The *San Jacinto* is barque rigged, and spreads 16,500 square feet of canvass.

Cost of materials for the hull	85,455 dols.
,, labour ,, ...	70,566
,, materials for masts and spars..	1,069
,, labour ,, ...	3,851
,, materials for boats	574
,, labour ,, ...	1,546
,, materials for rigging and blocks	1,018
,, labour ,, ...	4,512
Other items	25,000
	193,591 dols.

The data furnished by the trial trip of the *San Jacinto*, may be made available in determining, *à priori*, the friction of any other screw of known dimensions and revolutions per minute. We have seen that the friction of the screw of the *San Jacinto* amounted to 53·44 horse power; supposing the balance of the total power developed by the engines, after deducting for the "slip of the screw," for "propelling the vessel," for "working the engines," and for the "friction of the load," to be absorbed in the friction of the helicoidal surface on the water; the direct resistance of the edges of the blades

being probably but small, as they were sharply champfered. The screw surfaces were rubbed smooth.

In order to make this data applicable to other screws, the expression for friction must be reduced to some unit of weight, acting with a given speed on some unit of surface. The pound avoirdupois, 10 feet per second, and the square foot, are the most convenient for our purpose.

From many experiments, it appears that the law regulating quantity of friction of solids on fluids, is different from that regulating the quantity of friction of solids on solids, and instead of being proportional to pressure and velocity, is proportional to pressure, surface, and the square of the velocity. Assuming these hypotheses to be correct, we will determine the value of the friction of one square foot of helicoidal surface, moving with the velocity of 10 feet per second, from the data of the *San Jacinto*, premising—

As every helix of a helicoidal surface, from axis to periphery, is of a different length, increasing as the periphery is approached, and as each helix moves through its length per revolution of the screw, and as all the helices perform the same number of revolutions in the same time, it follows that each helix will have a different velocity; and taking a helix to represent an infinitely narrow surface of the helicoid, it also follows that these different surfaces, normal to the helices, will have different frictions, in the proportion of the squares of velocities and the areas of the surfaces. It is then necessary to ascertain the velocities and areas of these surfaces. The problem can be solved approximately, geometrically, with but little trouble, and with more than sufficient accuracy for practical purposes.

By this method, the surface of the screw projected on a plane at right angles to the axis, that is, considered as a disk, is divided by concentric circles into any number of rings or *elements*,—the greater the number of elements taken, the closer the result approximates the truth. The centre line of each element is taken as the length of the element, and is determined as follows:—

The development of a helix upon a plane, is the hypothenuse of a right angled triangle, whose base is the circumference normal to the distance of the helix from the axis considered as a radius, and whose height is the pitch. We have, therefore, the base and height of a right angled triangle, given to find the hypothenuse, and the hypothenuse or helix multiplied by the breadth of the element gives its area.

We have now all the quantities for the calculation, excepting the pounds avoirdupois per square foot of surface for the speed of 10 feet per second. This we obtain by representing the unknown weight by x, and making the calculations with it for each element; then summing up the column so obtained, and dividing by 33,000, we obtain the expression in horse power multiplied by x. Making these calculations on the screw of the *San Jacinto*, and returning to the data furnished by that vessel, when the friction of the helicoidal surfaces is given at 53·44 horse power, we ascertain, by dividing the 53·44 by the horse power multiplied by x, as above obtained, the unknown weight in pounds avoirdupois—observing that the helicoidal surface must be taken for *both* sides of the screw.

In this manner the friction of one square foot of helicoidal surface, moving in its helical path with a velocity of 10 feet per second, is determined from the data of the *San Jacinto*, to be 0·6195 pounds avoirdupois.

An examination of the subjoined table will explain the *modus operandi* without further illustration.

It may be thought that the friction from the propelling face of the blade is greater than the friction from the opposite face, by reason of its pressure on the water. Should this be the case, however, the aggregate frictions from both sides of the blade would remain the same as though this pressure did not operate in inequality; for it is evident, that if this pressure *increases* the friction on the pressing face, it must, in an equal degree, decrease the friction on the face removed from the pressure.

Indicator Diagrams.—No. 1. From top of port cylinder; mean effective pressure per square inch, 14·9 lbs.; revolutions of screw and double stroke of piston per minute, 31.

No. 2. From bottom of port cylinder; mean effective pressure per square inch, 14.95 lbs.; revolutions of screw and double stroke of piston per minute, 31.

No. 3. From top of starboard cylinder; mean effective pressure per square inch, 20·15 lbs.; revolutions of screw and double stroke of piston per minute, 31.

No. 4. From bottom of starboard cylinder; mean effective pressure per square inch, 18·75 lbs.; revolutions of screw and double stroke of piston per minute, 31.

From the above, and a number of other diagrams taken during the trip, with the engines working at 31 double strokes of piston per minute, the area of the mean effective pressures was 16·29 lbs. per square inch of piston.

CALCULATIONS ON THE SCREW OF THE U.S. STEAMSHIP SAN JACINTO.

Diameter $14\frac{1}{2}$ feet; length on hub, in the direction of axis, $2\frac{1}{2}$ feet; length at diameter at $7\frac{1}{2}$ feet, in direction of axis, 4 feet; length at periphery, in direction of axis, 4 feet; diameter of hub, 28 inches; pitch, 40 feet, expanding to 45 feet, mean $42\frac{1}{2}$ feet; revolutions per minute, 31; number of blades, 4.

Pitch.	Radii of ele'ts.	Circumferences normal to radii of elements.	Lengths of Screw in Direction of axis at radii.	Fractions of Pitch used.	Lengths of Elements for one convolution of thread.	Lengths of elements used.	Breadth of elements.	Helicoidal surfaces of elements.	Speeds of elements per sec.	Speeds of elements per min.	Friction *both* sides of Screw.
A	B	C $2 B \times 3{\cdot}1416$	D	E $\frac{D \times 4}{A}$	F $\sqrt{(A^2 + C^2)}$	G $F \times E$	H	I $G \times H$	J $\frac{K}{60}$	K $F \times 31$	L $\frac{J^2}{10^2} \times K \times 2 I \times 0{\cdot}6195$ lbs.
Feet.	Feet.	Feet.	Feet.		Feet.	Feet.	Feet.	Sq. Feet.	Feet.	Feet.	
42·5	1·27	7·980	2·500	0·235	43·243	10·162	0·208	2·114	22·341	1340·53	17526·584
,,	1·50	9·425	2·542	0·239	43·532	10·404	0·250	2·601	22·491	1349·49	21998·817
,,	1·75	10·995	2·666	0·251	43·898	11·018	,,	2·754	22·680	1360·84	23885·132
,,	2·00	12·566	2·833	0·267	44·317	11·833	,,	2·958	22·897	1373·83	26397·329
,,	2·25	14·137	2·958	0·278	44·790	12·452	,,	3·113	23·141	1388·49	28678·365
,,	2·50	15·708	3·125	0·294	45·310	13·321	,,	3·333	23·410	1404·61	31788·155
,,	2·75	17·278	3·250	0·306	45·881	14·040	,,	3·510	23·705	1422·31	34757·853
,,	3·00	18·849	3·416	0·321	46·492	14·924	,,	3·731	24·021	1441·25	38443·072
,,	3·25	20·420	3·583	0·337	47·150	15·890	,,	3·972	24·361	1461·65	43928·101
,,	3·50	21·991	3·750	0·352	47·845	16·841	,,	4·210	24·720	1483·20	47276·820
,,	3·75	23·562	3·833	0·361	48·594	17·542	,,	4·386	25·107	1506·41	51602·739
,,	4·00	25·132	4·000	0·376	49·374	18·565	,,	4·641	25·510	1530·59	57274·720
,,	4·25	26·703	,,	,,	50·192	18·872	,,	4·718	25·932	1559·95	62020·623
,,	4·50	28·274	,,	,,	51·045	19·193	,,	4·798	26·373	1582·40	65427·253
,,	4·75	29·845	,,	,,	51·932	19·526	,,	4·881	26·831	1609·89	70089·053
,,	5·00	31·416	,,	,,	52·850	19·872	,,	4·968	27·306	1638·35	75192·741
,,	5·25	32·986	,,	,,	53·800	20·229	,,	5·057	27·797	1667·80	80742·842
,,	5·50	34·557	,,	,,	54·768	20·593	,,	5·148	28·297	1697·81	86712·096
,,	5·75	36·128	,,	,,	55·817	20·987	,,	5·247	28·839	1730·33	93549·518
,,	6·00	37·699	,,	,,	56·815	21·362	,,	5·341	29·354	1761·26	100427·393
,,	6·25	39·270	,,	,,	57·865	21.757	,,	5·439	29·897	1793·82	108049·968
,,	6·50	40·840	,,	,,	58·946	22·164	,,	5·541	30·455	1827·32	116356·658
,,	6·75	42·411	,,	,,	60·040	22·575	,,	5·644	31·021	1861·24	125248·404
,,	7·00	43·982	,,	,,	61·160	22·996	,,	5·749	31·599	1895·96	134846·379
,,	7·25	45·550	,,	,,	62·298	23·424	,,	5·856	32·187	1931·24	145167·621
,,	7·431	46.690	,,	,,	63·136	23·937	0·125	2·967	32·620	1957·22	76559·049
					Helicoidal Area of Screw			112·677			1763947·285

$$\frac{1763947{\cdot}285}{33000} = 53{\cdot}45. \quad \frac{J^2}{10^2} \times K \times 2\,I \times x = 2847372{\cdot}54\,x; \text{ and } \frac{2847372{\cdot}54\,x}{33000} = 86{\cdot}284\,x; \text{ and as } 86{\cdot}284\,x = 53{\cdot}44,\ x = 0{\cdot}6195.$$

COMPARISON OF THE RESULTS OBTAINED FROM THE SCREW OF THE 'SAN JACINTO,' AND THE PADDLE WHEEL OF THE 'SARANAC.'

Since writing the foregoing, I have obtained the log of the sister steamer *Saranac*, which enables me to make a comparison between the results obtained from the paddle wheel of that vessel, and the screw of the *San Jacinto*.

During the passage of the *Saranac* from Norfolk, Va., to New York, Oct. 15th, 16th, and 17th, 1850, the mean speed for 31 hours was 9·13 knots by log; revolutions of the wheels, 14·64 per minute; steam pressure in boilers per gauge, $13\frac{1}{6}$ lbs. per square inch; vacuum in condenser per gauge, 27 inches; throttle one-fourth open; cut off at $3\frac{1}{2}$ feet from commencement of stroke; smooth sea and *very* light breeze ahead. Mean draft of vessel, 15 feet 9 inches. Two inclined engines, cylinders 60 inches diameter, by 9 feet stroke.

Common paddle wheel, 29 feet diameter, 22 paddles in each wheel; each paddle 9 feet by 30 inches; immersion, lower edge of paddle $4\frac{1}{4}$ feet.

The mean effective pressure in the cylinder computed from the indicator diagram, taken under the above conditions, was 15·5 lbs. per square inch. The horse power developed by the engines would therefore be

$$\frac{(2827{\cdot}44 \times 15{\cdot}5 \times (9 \times 2) \times 14{\cdot}64)\ 2}{33000} = 699{\cdot}92$$

Taking the knot at $6082\frac{2}{3}$ feet, as used in the British Navy, 9·13 knots would be 10·518 statute miles. Taking the cubes of the speeds as the measure of the effects produced, and the indicated horse power as the cost of propulsion, and reducing them to proportionals, we shall have

	Powers.	Effects.
San Jacinto	1.1291	1·1438
Saranac	1·0000	1·0000

$$\text{and } \frac{1{\cdot}1438}{1{\cdot}1291} = 1.0130,$$

that is to say, the application of the power with the *screw* in the *San Jacinto* was more efficient than with the paddle wheel in the *Saranac*, in the proportion of 1·0130 to 1·0000; or the two systems in these particular cases may be considered as equally good.

The slip in the centre of reaction of the *Saranac's* paddle wheel was 23·7 per cent., which is about the usual average given. The loss by oblique action calculated as the squares of the sine of the angles of incidence of the paddles on the water was 13·3 per cent. The sum of the losses by the paddle wheel being 37 per cent. The *Saranac's* paddle wheel thus gave as favourable results as are found in sea-going steamers, and the equal effect obtained from the screw of the *San Jacinto*, show it to have very perfect proportions.

The *Saranac*, when she commenced the above-noted 31 hours' steaming, had only 231,827 pounds of coal on board.

CORRESPONDENCE.

SHIP-BUILDING IMPROVEMENTS.

To the Editor of the Artizan.

Sir,—When we see old-established wood and iron ship-builders taking out patents for the mechanical improvement of ships, we have a right to conclude that experience has taught them the necessity; at the same time, it is quite necessary that persons so engaged should see how far such improvements have been placed in their way, in the shape of patents allowed to remain in a hopeless state of abeyance, from their not being properly understood, or from interested motives, which too frequently operate to the disadvantage of inventors. This will save a useless waste of time and expense, and I will venture to say, practical men who have not had much time to study the scientific part of the question, will find it to their advantage to see to what extent they have been anticipated, before they venture to expend their money in patenting that which has already been patented.

I am induced to make these remarks, from having seen in the *Artizan*, and other mechanical works, plans for which I obtained patents, in conjunction with others, many years since, and with the humble hope of its being of some service to those engaged in ship-building who may not have had the opportunity of tracing the progress of those improvements which have been made within the last fifty years; and, as I have devoted so much time to the subject, my personal experience may help in some measure to explain what has been, and what remains to be, done in this important branch of practical science. My individual efforts to improve the construction of vessels date so far back as 1809; and in 1812, personal observation led me to make those improvements which Mr. White, of Cowes, calls the "long bow," and Mr. Scott Russell the "wave line," but which, even at this period and before, had been so largely practised by the Americans in the beautiful vessels which I have *since* seen on the various coasts of that country. Pursuing this improvement further, I completed in 1829 what is now termed the "clipper bow,' so successfully adopted in our mercantile marine; and having previously traced the mechanical defects of ship-building to the changeable principle of the parallelogram, which subjects them to continual alteration in form, with all its consequent evils, the unalterable principle of the triangle, which at that period formed no part of the naval architectural study, suggested itself to me as the most effective as it regards strength; and I felt convinced that, by the appropriate arrangement of material on this basis, a less expensive, stronger, and more buoyant ship might be built, than was at that time in general use.

Having made numerous plans, based on this principle, I submitted them to the Admiralty, by *special instruction*, for the improvement of the Royal Navy; but, agreeably to practice, *under Admiralty sanction*, they were taken advantage of by the Navy Office, and I was told that I "might seek redress in a court of law, if I thought fit," when I complained of the breach of confidence with which they had thought proper to visit me.

In 1819, I had an opportunity of witnessing the Indian canoes on the lakes and rivers of America, and was struck with the buoyancy and strength which I found they possessed; and from them I first conceived the idea of building vessels without compass or thick timber.

In 1823, I became acquainted with Mr. William Annesley, who had obtained patents in Europe and America for building vessels of board of three or more thicknesses; and at Montreal he built a steamboat, called the *Annesley*, to compete with one on the old principle of building called the *William Henry*; and I witnessed the superiority of the former, as it regards strength and speed, in a race which took place to try their relative merits. The waters of the St. Lawrence being low, the shoals impeded navigation; the *Annesley*, taking the lead, came in contact with one of them, and passed over uninjured; and the *William Henry*, following close in her wake, struck, and filled with water in a few minutes after having cleared the shoal.

This, with other proofs brought under my notice, convinced me that the double-boarded system had great advantages; but as Annesley's vessels were built with the material at right angles, perpendicularly and longitudinally, I felt assured that, by a different arrangement, the system might be improved, and that no more than two close thicknesses should be employed, with such appendages as the form and size of the vessel might make necessary, to obtain the required strength. On my return to England in 1827, I renewed my claims on the Admiralty, and found that the master boat-builder at Plymouth had been permitted to build ships' launches with two close thicknesses diagonally; but he did not attempt to apply the principle further.

Subsequently to this, I found that Mr. Brindly had taken out a patent for building ships and vessels of planks placed longitudinally, of three or more thicknesses, with perpendicular iron ties between each planking, and the instance of the *City of Rochester*, built by him, as recorded in the Parliamentary Report on Shipwrecks in 1836, is quite conclusive that no iron or wooden ship, on the common mode of building, would have stood such beating on the rocks as she did, in the memorable gale of 1825, as stated before the committee.

The next patent taken out on the double-boarded system was in France, by M. Fouache, of three close thicknesses, two diagonally, and one on the inside longitudinally; but as he had not secured his right in England, it became open to the builders on the Thames, and Mr. Samuel King, of Limehouse, was the first to build upon it. In 1836, Mr. Lang, then a draughtsman in Woolwich Dockyard, and now master shipwright of Chatham, constructed the *Ruby*, for the Diamond Company, on Fouache's system, and which he represented to the Admiralty as the invention of his uncle, the master boat-builder alluded to; and the Admiralty have built more than one vessel, at Mr. Lang's recommendation, with the belief that it was invented in the service.

At this period, finding that I was not safe, without protecting myself by patent, I built several barges on the Thames, and canal-boats on the Continent, of *two* close thicknesses diagonally; and they have been from that time to this in constant employ, without repairs worth naming, and without having been caulked at any time.

Prompted by such proofs of efficiency, I have since obtained patents which

embrace the building of every class of ship and vessel; but I have taken care not to have more than *two* thicknesses in close contact, as experience gave me proof that, when the material was confined, as in the instance of previous patents with three and more thicknesses of planking, decay was greatly facilitated; and I have also arranged the various details, so as to meet the wants and wishes of ship-builders disposed to embrace the advantages which my patents secure, without giving them the trouble of altering any part by modifications, which they will find amply provided; and I cannot but think, if Messrs. White, of Cowes, had taken the trouble to investigate what has been done, as it respects the building of ships and vessels on the double-boarded system, they never would have attempted to secure by patent that which was open to them without, as the precise mode which they describe in No. 2, as distinct from No. 1, in the sketches published in the May number of the *Artizan*, has been acted upon, to my certain knowledge, by builders on the Thames; besides which, my individual patents both clearly define the process of jointing the material at the keel, without crossing it, in several ways, much more effectively; but they are not too late to retrace their steps in part, as they have not enrolled the specification of their patent; and I should have been happy to have given them earlier information on the subject, had I known that they contemplated taking the course which induces me thus to allude to it.

I remain, Sir,
Your obedient humble servant,
JOHN POAD DRAKE,
Naval Architect.

St. Austell, Cornwall,
May 12th, 1852.

STEAMBOAT EXPLOSIONS IN THE UNITED STATES.

THE fearful number of explosions on board steam vessels in the United States, seems, at last, to have struck terror into the most rash. An appeal to government for a stringent act is talked of. The following article, from the *Scientific American*, will show what a passenger's life is worth, across the Atlantic.

The steamboat *Redstone* lately commenced running between Cincinnati and Madison, and on Saturday, at 12 m., left the latter place for Cincinnati on a trial of speed, with about twenty cabin passengers. The number on deck is not known. The *Redstone* shoved out, and backed down from the landing about 100 yards. A strong wind was blowing in the shore, and it was with difficulty that she could back her way out. At the second revolution she made to start forward, her three boilers exploded at the same time, with a tremendous noise, shattering and tearing the boat literally to atoms. She sunk in less than three minutes, in twenty feet of water. The ladies' cabin and aft part of the boat, from the main deck up, in its shattered condition, took fire, and burned down to the water's edge. In the explosion, her chimneys were blown nearly across the river.

The awful force of the explosion can be conceived, from the fact that a large piece of one of the boilers was blown half-a-mile, lacking five or six yards, from the wreck. Eleven bodies were blown into a corn field at some distance from the water. Among them those of the first and third engineers.

The people of Carrolton and the vicinity hurried to the scene, and twenty-five dead and wounded bodies were immediately borne to a small farm house on top of the hill which rises back of the river, and which was converted into a hospital. The inmates of this house gave up their rooms, bedding, and everything in their possession, to the suffering. The scene here beggars all description. The mangled and ghastly corpses by the side of the wounded and dying, with inadequate medical aid and means for the care of the latter; the floor of the rooms covered deep with blood; this, and the view of the scattered wreck, and the awe-stricken multitude on the shore below, made up a scene of horror before which the intensest paintings of Sue and Dickens pale and grow dim.

The river, for some distance below Carrolton, was strown with the fragments of the boat, machinery, furniture and clothing.

Small pieces of bedding and clothing were found at the distance of very nearly half-a-mile back from the river, while the trees along the shore were littered with the fragments of the same and of the wreck.

The cause of this explosion is very evident: it was recklessness—that culpable public, and let us say, legalised murderer. Almost every week we have to record some such calamity. Within three weeks no less than one hundred persons have lost their lives by steamboat explosions on the river between Cincinnati and New Orleans. All the laws which have been enacted, and all the safety valves which have been invented, have failed to reduce the number of explosions; there are just as many now as ever. Our government, in their zeal for the lives of some of our American sailors, cruelly treated in Japan, are said to be fitting out an expedition to punish those Asiatics; this shows a zeal for something more than a humane principle, or why are our citizens at home allowed to be killed so recklessly by such terrible explosions as that of the *Redstone?*

THE PACIFIC ROYAL MAIL STEAM NAVIGATION COMPANY'S NEW IRON STEAM-VESSEL, "SANTIAGO."

Built and fitted by Mr. Robert Napier, Glasgow, 1851.

Dimensions.	Feet.	10-ths.
Length on deck	246	3
Breadth on do., amidships	28	2
Depth of hold, do.	15	8
Length of poop	69	3
Breadth of do.	26	3
Depth of do...	7	8
Length of engine-space	85	3
Tonnage.	**Tons.**	
Hull	$807\frac{5}{100}$	
Poop	$153\frac{85}{100}$	
Total..	$960\frac{90}{100}$	
Contents of engine-space	$411\frac{32}{100}$	
Register	$549\frac{58}{100}$	

A pair of side-lever engines, of 406 horses nominal power. Diameter of cylinders, 73 inches × 5 feet 6 inches stroke; diameter of air-pumps, 41 inches × 3 feet stroke; diameter of paddle-wheels, extreme, 27 feet, and 26 feet 4 inches, effective; 20 floats, 8 feet 9 inches × 2 feet 4 inches. Has 4 tubular boilers, 2 forward and 2 aft, with 2 funnels. There are 12 furnaces, 3 in each boiler; diameter of tubes, $3\frac{1}{2}$ inches. The boilers are not fired from the engine-room, there being two coal bunkers, one forward and the other aft, each capable of holding 250 tons of coals. On the trial-trip in September last, this vessel made the run from Greenock to Rock Lighthouse, Liverpool, a distance of 215 miles, in 14 hours and 52 minutes, the draft of water being 13 feet 6 inches, forward, and 14 feet, aft. The steam-pressure was (mean) 24 lbs. per square inch, the engines making $23\frac{1}{2}$ revolutions per minute, with a consumption of 30 cwt. of coals per hour (the steam-pressure on station to be 16 lbs.). Will carry 600 tons of cargo, and has accommodation for 150 passengers; the saloon is 69 feet long, 25 feet 6 inches broad, and 7 feet 6 inches in height, and fitted up in splendid and tasteful manner. Between the paddle-cases, there is a hurricane-deck, on the top of which is a steering-wheel and compass, and the same aft, so that they can steer the vessel by either of these, as it may suit. She is intended to ply on the station from Valparaiso to Panama (calling at 34 ports on the voyage, going and returning), a distance of about 3,000 miles. Carries 6 boats.

DESCRIPTION.

A full-male figure-head; sham quarter galleries; square-sterned and clinch-built vessel; clipper bow; two decks and a poop; standing bowsprit; three masts; barque-rigged. Port of Liverpool; commander, Mr. John Hind.

LOG OF THE GLASGOW.

THIS fine steam-ship arrived at Greenock on the 14th, at five o'clock, afternoon, after a run from New York of 12 days and 19 hours, mean time. The regularity with which her speed was maintained will be seen from the log, which we subjoin. She brings 43 passengers and a full cargo.

ABSTRACT OF THE LOG.

May 1.—N.E.—Noon, abreast the wharf—set on full speed; $12\frac{1}{2}$ p.m., slowed the engines in a fog; 2 p.m., came to anchor in the lower bay' on account of a dense fog; 4 p.m., weighed anchor; 5 p.m.' abreast of Sandy Hook; 6 p.m., landed pilot of light-ship—dense fog—set on full speed—light breezes.

— 2.—N.E. to N.N.W.; 180 miles; 40 N. lat., 70·30 W. long.—Light breezes, and hazy—latter part square-sails set.

— 3.—Calm; 207 miles; 41·7 N. lat., 66·2 W. long.—Steaming only.

— 4.—E.N.E.; 200 miles; 41·38 N. lat., 62·02 W. long.—Strong breezes and easterly sea; 11 a.m., exchanged numbers with the British barque *Creole*, bound west—steaming only.

— 5.—E.N.E. to N.W.; 230 miles; 43·5 N. lat., 56·54 W. long.—First part, strong easterly winds—steaming only; latter part, square-sails set.

— 6.—N.W. to N.S.W.; 220 miles; 44·46 N. lat., 52·35 W. long.—Light breezes and fine weather—carrying all sails and studding-sails.

— 7.—W.S.W. to N.W.; 250 miles; 46·38 N. lat., 47·20 W. long.—Light breezes and fine weather—carrying all square-sails and studding-sails; 2 p.m., exchanged numbers with the barque *Countess of Musgrave;* 4 p.m., exchanged numbers with the ship *Southampton*—both bound westward.

— 8 —N.W.; 260 miles; 49·4 N. lat., 42·0 W. long.—First part, light breezes—all sails set; latter part, fresh winds.

— 9.—N.N.W.; 270 miles; 50·42 N. lat., 35·31 W. long.—Strong breezes and cloudy weather, all sails set, and part studding-sails.

— 10.—N.W.; 276 miles; 52·9 N. lat., 28·22 W. long.—Strong breezes and dark cloudy weather—carrying all sails.

— 11.—N.W.N.-East; 226 miles; 53·14 N. lat., 22·90 W. long.—Light airs, and variable, with rain—all sails set.

— 12.—W.N.W.; 220 miles; 53·56 N. lat., 16·9 W. long.—Light airs and rainy weather—all sails set.

— 13.—W. to N.E.; 208 miles; 54·36 N. lat., 10·11 W. long.—First part, light airs; latter part, strong winds and heavy easterly sea—steaming only.

— 15.—E.N.E. to N.W.; 240 miles.—First part, strong easterly winds and heavy rain; latter part, fresh westerly winds and cloudy weather; noon, abreast off Sunda; 2·30, abreast off Pladda; 4, abreast off Cumbraes; 5 p.m., came to anchor at the Tail of the Bank.

Passage—12 days 19 hours, mean time.

SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 13th, 1852.

The first Paper read was "Account of a Swing Bridge over the River Rother, at Rye, on the line of the Ashford and Hastings branch of the South-Eastern Railway," by Mr. C. May, M, Inst. C.E.

This bridge, which was constructed from the designs of Mr. P. W. Barlow, by Messrs. Ransomes and May, of Ipswich, although similar in principle to others previously erected, presented some difference in the construction,—in the arrangement of the tie-bars, in the rollers, and in other details. The girders were 112 feet long, 3 feet 6 inches deep in the centre, and 2 feet 6 inches at the ends, made up in four lengths, one joint being in the centre, immediately over the support, and the others between the centre and the ends. These girders were secured together at their ends, by means of cross girders, the under sides of which were planed and inclined, so as to be slightly lifted, when swung home to their places, on girders secured to the land piers. Provision was made on the under side of the main girders, at three places on each side of the centre of the bridge, for receiving the tie-bars, which all tended to one point over the middle. Each tie-bar was four inches by one inch in section, and was adjustable for tension, by a right and left-handed screw, the nut of one end of which was in the tie-bar, and the other between two plates of wrought-iron, resting on the side standards, or A frames, which were connected together by a wrought-iron arch.

The turning of the bridge was effected by means of spur gearing, worked from a platform projecting from the face of each girder. Two men could with ease open the bridge in two minutes; the total weight of metal, in the moving part, exclusive of the roadway, was about 130 tons.

The next paper read was, "A Description of the Lattice-beam Viaduct, to carry the Waterford and Kilkenny Railway across the River Nore, near Thomastown, County Kilkenny," by Captain W. S. Moorsom, M. Inst. C. E.

The span of the bridge was extended to 200 feet, chiefly in order to avoid the interference of the Inspecting Officers of the Board of Works, Ireland, whose proceedings had, in other cases, been so vexatious as to cause great delay in the execution of works, and, in one instance, of a small arch of twelve feet span crossing a stream, with a bottom of firm limestone rock, they had insisted on the excavation of this rock to a depth of 6 feet below the bed of the stream, and caused the foundations to be brought up in masonry from that depth. The length of the girder enabled the piers to be constructed on the banks, without the aid of cofferdams. The foundation was strong loam and gravel, for an average of about 10 feet, at which depth the limestone rock was reached The river was subject to floods, which, rising rapidly, spread across the valley for a breadth of 180 yards, and to a depth of about 16 feet in mid-channel.

The progress of the structure was delayed by the financial affairs of the railway company; and on the original contractors resigning the work, it was completed by several others, among whom was Mr. R. Mallet, M. Inst. C.E., whose able assistance, in the execution of the work, was deservedly eulogized by the author.

Details were given of the limestone piers, the material for which was quarried contiguously to the bridge; as also of the lime, and the modes of working.

The timber used for the lattice-beams, or girders, was Memel fir. The whole was worked to templates and gauges, and the beams were constructed with a curve, or "camber," regulated by cleats spiked to the staging on which the beams were built. The intersections of the diagonals were all very accurately fitted, and double spiked; the waling pieces were drawn close by bolts, and the joints made water-tight; the diagonal flooring was then bolted and spiked down; and on the trial of the beam it was found that, on knocking away the cleats, the deflection was about 3 inches, which gradually increased to $3\frac{1}{4}$ inches; after passing several trains across, at speeds varying between twenty miles and thirty miles an hour, the ultimate deflection (without a load), became $5\frac{1}{8}$ inches. The maximum load had been 65 tons. The Government Inspector, however, tested it by a train of loaded waggons, extending the entire length of the arch (200 feet), and weighing 146 tons. The result of this was, that the beam deflected $2\frac{1}{2}$ inches under the heaviest load, and rose again $1\frac{1}{4}$ inch, thus leaving a permanent deflection, after the trials were concluded, of about $6\frac{3}{8}$ inches. The shrinking of the timber, and the regular traffic, produced a further sinking, so that now the entire amount was $3\frac{1}{4}$ inches; but the engineer had calculated and allowed for a subsidence of 9 inches.

Details were given of the quantities of materials of all kinds used in the bridge, the entire cost of which was about £8,100:—that of the timber arch alone was about £15 per foot run, and the cost of the whole mass, taken as a solid, averaged three shillings and three-pence halfpenny per cubic yard.

April 20, 1852.

The paper read was "The Economy of Railways, as a means of transit, comprising the classification of the traffic, in relation to the most appropriate speeds for the conveyance of passengers and merchandize," by Mr. Braithwaite Poole, Assoc. Inst. C. E.

After referring to the influence which cheap and rapid communications had on the prosperity of a nation, the author alluded to the rise of the railway system in this country, expressing the belief, that it would have been economical and wise if the legislature had, in the first instance, determined the lines on which the system of railways should have been constructed throughout the kingdom, so as to have avoided the present ruinous competition. The passenger traffic now exceeded, annually, four times the entire population of Great Britain, and was conveyed at three times the speed and one-third the fares formerly charged by the old stage, or mail coaches, whilst the cost of conveyance of merchandize, minerals, and agricultural produce, had been reduced full 50 per cent., as compared with the rates charged on canals and turnpike roads fifteen years ago. The ordinary fares for passen-

gers ranged from twopence three-farthings to a halfpenny per mile, and for merchandize, from one penny to sixpence per ton per mile.

The author then proceeded to consider the economy which might be introduced into the working of railways, and divided the snbject into sixteen differeut heads, each of which referred to some particular point, where it was thought a reduction of expenses might be made. The principal point advanced was the amalgamating, or working, of all the railways in four great divisions, and ensuring unity of management in every department, in the maintenance of the permanent way, and of the rolling stock, as well as in their manufacture, several improvements in the construction of the waggons being suggested.

If a general classification of trains were arranged throughout the kingdom, separating each class, and running them at different speeds whenever practicable, it was thought that it would be conducive to the interest of all parties, as it was urged to be a manifest injustice towards those who paid the highest fares, to find third class passengers arriving at the same time with them. Punctuality and regularity required to be strictly atteuded to for the maintenance of a certain definite speed.

Numerous instances were adduced to show the vast advantages and economy of the railway system, without which the Penny Postage could not have been achieved, or the Great Exhibition rendered available to the multitude; the produce of the land and sea in vegetables, fruit, meat, fish, all provisions and fuel, would have remained as limited in consumption as heretofore, and the poor man's fireside in the rural districts would never have been warmed by coal.

May 18, 1852.

The paper read was "Observations on Artificial Hydraulic, or Portland, Cement; with an account of the Testing of the Brick Beam erected at the Great Exhibition," by Mr. G. F. White, Assoc. Inst. C.E.

After detailing the experiments made by the late Sir Isambard Brunel, the paper noticed the peculiarities in the practice of the English and foreign engineers in the use of cements and limes. It was stated that, in England, the natural cements were plentiful, and the mode of construction being generally in brickwork, quick-setting cements were preferred; whereas abroad, the natural cement stones were, comparatively speaking, rare, and the use of bricks rather the exception than the rule. In some cases it was found, that even the best natural hydraulic limes did not set with sufficient rapidity, in salt water, to do away with the necessity for using pozzalanos; and some of the attempts made, at various periods, to substitute artificial pozzalanos for the very expensive natural products of that nature, were then described. The unfavourable results of these attempts, and the manner in which M. Vicat explained them, were detailed. A sketch was then given of the course of investigation followed in England by Mr. Frost and General Sir Charles Pasley, from which it appeared, that until the introduction of the Portland cements, no artificial compound had been discovered which possessed the same or greater powers of resistance than those of the natural cements. The advantages of the Portland eement were stated to be, that it had nearly all the qualities of rapid setting presented by the natural materials of the same class; and in addition, that as it was capable of supporting variable proportions of sand, it could be used as a mortar, the rate of setting of which might be modified at will, and the powers of resistance of which were stated to be much greater than those of either the cements or the limes thus replaced.

A general description of the manner in which the Portland cement was now manufactured, and of the methods of testing the article, were then given; and it appeared that, after seven days, the cohesive strength of the neat cement was equal to above 100lbs. on the square inch, and that, after six months, this became equal to not less than 414lbs. per square inch. M. Vicat had stated, in 1851, in a communication to the *Annales des Ponts et Chaussées*, that by the use of Portland cement alone, or what he termed "overburnt lime," it would be possible to form immense artificial blocks, capable of resisting the action of the waves and of the shingle upon the sea-shore, an action which, it was well known, rapidly destroyed the natural cements and the pozzalanic mixtures, whether of natural or artificial pozzalanos.

The several applications of the Portland cement, as a concrete, as a mortar, and as a stucco, were then alluded to, and reference was made to the early failures in forming large artificial blocks; and an account was given of the mode now adopted in constructing them at Dover and Alderney harbours of refuge, and likewise of those employed to protect the extremities of the breakwater of Cherbourg. At Dover, the hearting of the piers, below high-water mark, was executed in blocks of concrete, composed of cement and shingle, in the proportions of 1 to 10, and occupying about three-fourths of the volume of the separate materials measured in the dry state. Each block contained from 30 cubic feet to 120 cubic feet, and weighed from 2 tons to 7 tons. At Alderney, a species of concrete, composed of cement, sand, and shingle, was placed in a mould with rubble stone, bedded irregularly in the mass, the proportions being about one part of cement to ten parts of foreign materials. At Cherbourg, the system adopted was to build immense blocks of rubble masonry of not less than 712 cubic feet, and weighing about 52 tons. These blocks were floated out from the places where they were constructed, and sunk as "*pierre perdue;*" but this had not on all occasions been able to resist the transporting power of the waves. The manner of using the cement was in the form of mortar, composed of one part of cement to three parts of sand.

It had been stated by M. Vicat, that the powers of resistance to compression absolutely required, in substances exposed to the action of the sea, must be at least equal to 40lbs. per square inch, and of that to tension at least equal to 9lbs. on the square inch. Now, the resistance of the artificial stone blocks, after an interval of nine months, was not less than 1,700lbs. per square inch, when the effort was one of compression, or than 240lbs. per square inch, when it became an effort of tension, or little inferior to that of Portland stone itself.

Attention was called to the fact that the Portland cement adhered more energetically to the Portland stone than to any other material. This degree of adhesion did not seem to depend so much upon the absorbent powers of the substances connected together by the cement, as upon some coincidence in the manner of their crystallisation.

The applications of Portland cement to the purposes of stucco for external works were noticed. Its advantages were stated to consist in its agreeable colour, without the intervention of paint or lime-white, its power of resisting frost, and its freedom from vegetation; all which were attributed to the close contact of its constituent parts, and to the surface being perfectly non-absorbent. For the same reason, it was asserted that the Portland cemcnt was emineutly adapted for the construction of cistern and baths, and for the various descriptions of statues and fountains, &c., now made of artificial stone.

The paper concluded by a description of the brick beam experimented on at the Great Exhibition of 1851, an account of which has already appeared in the scientific journals of the period, and from which it was deduced that the strength of Portland cement, as compared with Roman cement, was in the ratio of $2\frac{1}{8}$th to 1.

BEET-ROOT BEER.

Mr. R. Baker has published a letter on this subject, in one of the Agricultural Journals, of which the following is an abstract:—

"As regards the seed of the white Silesian sugar beet, I obtained it last year through a friend from Belgium, myself and three others in this district having contracted with a sugar manufacturer to grow eighty acres, but as that speculation failed, I then endeavoured to apply it beneficially to other purposes. Twelve bullocks were stalled, and fed with it and Swede turnips mixed, from the 1st of November to the 10th of February, when they were sold at £19 15s. each in Smithfield. They of course were fed with oil-cake, meal, and cut chaff in addition; but it was admitted by all who inspected them that they made flesh faster than we had ever before experienced, fully establishing the utility of beet for fattening purposes. Little attention appears to have been paid by foreign growers in selecting the roots for seed; and with a little care in that respect for a few years, I have no doubt it may be made to produce one-third more in quantity, and that of very superior quality, so as to allow it to compete with the mangold wortzel and Swede turnip as to acreable value. My produce last year was from 10 to 16 tons per acre, whilst the mangold wortzel was from 16 to 24 tons in the same field. The beet should be planted closer than the mangold wortzel, and, perhaps, would yield a greater crop by leaving double the number of plants. The leaves of this plant are much preferred by cattle, and the roots left in

my garden for seed have had all the crowns picked out by small birds, while they rarely, if ever, touch the mangold wortzel. The planting will be sufficiently early if effected by the 12th of May, though the last week of April would be preferred. The after culture is the same as that pursued with mangold wortzel; the leaves will repay the whole expense of pulling and collecting the roots. The process necessary to convert it for brewing should be effected early: the middle to the end of October is most suitable. After thoroughly clearing from dirt, the roots should be sliced with a Gardner's patent turnip slicer, and spread thinly upon a barn or malting-floor, and thoroughly turned over for three or four days or more, until the moisture is partially evaporated; they then should be gradually dried upon a malt or chicory kiln, taking care not to burn them in the process, as the colour of the beer, as with malt, depends entirely upon this process being carefully conducted; when dry and crisp, they may be removed and kept in a dry situation for use. The process of brewing is as follows:—If combined with malt, I brew 12 bushels of malt, and mash it the first time in the ordinary way. I then add 18 bushels of the dried root for the second wort; from this a third wort is taken, and the whole is put to fermentation at 45° to 50° Fahrenheit, and turned separately or together; $1\frac{1}{4}$lb. of good hops to each bushel of malt being added, and $1\frac{1}{2}$ bushels of the beet being used. The wort is boiled in the usual way; from this I obtain seven hogsheads of beer, which in three months is quite clear and ready for use. Or, I brew with the beet-root alone, putting $1\frac{1}{2}$ bushels for each bushel of malt; but I do not find it quite equivalent to a bushel of malt when used alone, although when combined with malt it is so, but 2 bushels would be more than equivalent. The beer brewed entirely from the beet, if properly managed, is quite equal to that brewed from malt and beet, and is first ready for use; is about the colour of London porter—quite as bright, and, as most persons state, quite as good. One ton of beet will produce from 16 to 18 bushels of dried root, the cost of drying about 12s. per ton. Some did not cost so much, but the maltster objected to dry more under that price, as it requires longer time and a stronger fire than malt to effect the object well."

RECENT AMERICAN PATENTS.

For an *improvement in pianofortes;* Frederick Mathushek, City of New York, October 28.

Claim.—"What I claim as my invention is, 1st, the manner, substantially as herein described, of placing or arranging the strings of a pianoforte, to wit, the shorter strings, or strings of the higher octaves, across the narrower portion of the instrument, and the longer strings, or those of the lower octaves, crossing them in the direction of the greatest length of the instrument, so as to include the greatest possible size of string within the instrument, for the purposes specified."

For an *improvement in mineral composition resembling jasper;* John Paige Pepper, New Britain, Connecticut, December 16.

Claim.—"What I claim as my invention is, the manufacture of a mineral composition, having the external characters above described, by the fusion of clay with alkali, soda, lime, and sulphate of copper, as above described, or their equivalents, and working the composition into articles of utility and ornament, in the manner above described."

For a *rotary swaging machine;* Perry G. Gardiner, City of New York, December 23.

Claim.—"What I claim as my invention, discovery, and improvement, is, the compressing, drawing, swaging, or working into shape, wrought-iron car wheels, and other metallic discs, by means of two dies or swedges, suitably shaped, one of which is forced towards the other, while it at the same time revolves on its own centre, its axis of revolution being the same as that of the disc which is acted upon; the other die being either stationary, or having a revolving motion in an opposite direction to that of the first-mentioned die, and with the same axis of revolution; the said two dies or swedges operating substantially as described, and being moved by any competent arrangement of machinery, substantially as described."

For an *improvement in ventilating windows for railway cars;* Henry M. Paine, Worcester, Massachusetts, January 6.

Claim.—"I am aware that repeated attempts have made to prevent the sparks from entering the cars, by deflecting boards or slats, but they have been outside, or independent of the windows; they could not be adjusted by the passengers themselves; they are an additional expense, and cannot effectually shield off the dust and sparks, unless they should cover the window, so as to obstruct the view therefrom; therefore, I do not wish to be understood as not claiming a deflector; but what I do claim as my invention is, the construction and arrangement of the windows of a car or carriage, in the manner and for the purpose set forth, by causing the parts of the window to stand at an angle outward when closed, and opening inward to a line with the inside of the car, as described, whereby I insure ventilation, without the annoyance of dust, by means of the window alone, without the addition of other deflectors."

Ship Building in New York for 1851.—The following is the number of vessels finished and remaining on the stocks in New York, at the close of the year 1851:—

	Finished.	Unfinished.	Total.
Clipper ships	15	3	18
Ships	7	1	8
Steamships and propellers	17	5	22
Steamboats	20	6	26
Barks and brigs	3	1	4
Pilot boats and schooners	21	7	28

Total, 106 vessels of all classes, whose aggregate tonnage is equal to 80,761 tons. Of the 22 vessels under the head of steamships and propellers, 17 are side-wheel steamers.

The total number of side wheel sea-going steamers built up to this date is 53.

PROFESSOR EDWARD SOLLY, F.R.S., ON THE VEGETABLE SUBSTANCES USED IN THE ARTS AND MANUFACTURES.

(Extracts from Exhibition Lectures delivered before the Society of Arts.)

Oils.—On turning to the great class of vegetable oils, we find the same rich abundance of nature to admire; and here, as in the preceding case, we cannot but wonder at the comparatively small number used by manufacturers, out of the hundreds presented to us by the fruitful earth. It would seem almost as if, in regard to the productions of the earth, there were certain vested rights which might not be set aside, and that we were bound to go on importing and using the same substances which our ancestors did, irrespective of the question, whether other substances might not be advantageously substituted for them. Of late years, attention has been paid to some of the many good vegetable oils of Asia and Africa, and large quantities have been imported; yet there are still many which are quite as good but almost unknown, though new oils are anxiously desired by candle and soap makers, by wool spinners, by engineers in general for diminishing friction, and for various other purposes. Cocoa-nut and palm-oil have been extensively imported from Ceylon and the coast of Africa, chiefly for the manufacture of candles; but there are, besides these, at least two dozen other solid vegetable oils, almost unknown to commerce, and well worthy the attention of manufacturers, such as the vegetable tallow of the Vateria indica, the fat of the various Bassias, the oil of the Carapa, the oils of the Garcinia and of the Vernonia, the vegetable tallows of China and the Archipelago Islands. The various vegetable waxes, too, of which there are likewise many, and which may be had largely in Mexico, South Africa, and North America, deserve notice. Some of these substances are already becoming known to manufacturers, especially certain of the kinds of vegetable tallow from China; and the importation of vegetable wax is increasing. Till recently, indeed, the latter substance could not be imported into England, for the high duty imposed upon it amounted to a prohibition. Whilst bees' wax paid a duty of 10*s.* per cwt., vegetable wax was charged £5 12*s.*, or at the rate of £112 per ton. Recently the duty has been equalised, and the protection which long existed in favour of bees has been withdrawn.

Amongst the fluid fixed oils, similar facts are to be observed; there are many excellent oils wholly unknown to commerce, but admirably adapted to the wants and requirements of manufacturers; these, too, are waiting for

some fortunate circumstance to bring them to the notice of those able to turn them to practical uses. Let us hope that it may not be the devastating and paralysing influences of war which shall give rise to the introduction of these substances! I might mention many curious facts to show how difficult it is to introduce a new article of trade, however good, if in any way it interferes with the established custom and routine of commerce, and how in some cases it can only be brought in under a false name, in order to obtain an entrance into our ports! Till quite recently, the linseed-oil required for Government use, throughout the Indian empire, was wholly sent out from Europe; and it is only within the last few years that it has been found out, that the native-grown linseed is quite as good as the best which can be had from Europe.

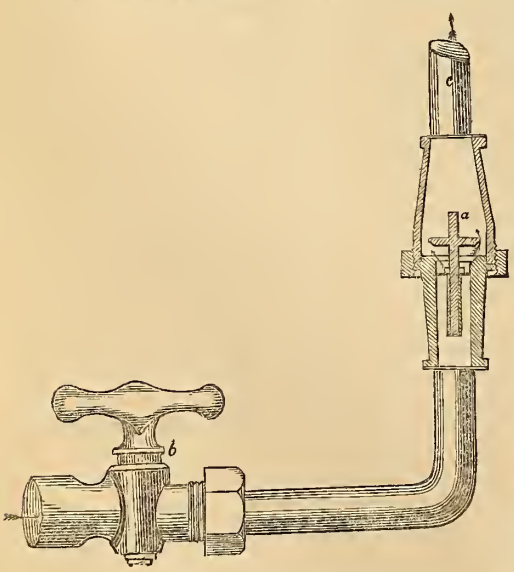
In preparing oils for exportation, some care and attention must be paid; when well expressed, oil has little tendency to change, but when prepared in a careless and slovenly manner, contaminated with mucilage and other matters from the seed, it soon becomes rancid, and then will not bear a sea voyage of any length. The value of these new oils, therefore, will mainly depend on the care and skill bestowed upon their preparation: if expressed with rude and imperfect machinery, they will arrive foul, discoloured, rancid, and of little value; whilst, if carefully prepared, they will come over fresh and sweet, and fit for any purpose in the arts, to which they may be applied. Again, in collecting these oils, in our colonies and elsewhere, some system must be adopted for the cultivation and preservation of the plants yielding them; the supply cannot fail to be small and uncertain, if the same reckless mode of cutting down trees is adopted, as has been the case with the trees yielding gutta percha and caoutchouc—a system which gradually, but surely, leads to the extinction of the trees themselves. These remarks may to some seem almost self-evident, but they are nevertheless generally overlooked, and the usual consequences are disappointment, failure, and ruin.

Several of the little-known volatile oils were highly interesting; the sweet-scented, fragrant ones are all of value, though their importance in the arts is fast diminishing, as the progress of science brings us nearer and nearer to the mode of preparing them artificially. Amongst these oils several are of value, in consequence of their strong solvent powers over resin. Thus, for example, we have the excellent oil of the *Eucalyptus Piperita* and *Leptispermum*, from New South Wales;—that country, yielding at the same time valuable resins, and essential oils capable of dissolving them, and thus of rendering them practically useful in the arts.

In connexion with this part of my subject, I would also draw your attention to a class of curious empyreumatic volatile oils, obtained by the destructive distillation of the bark of trees, such as the birch oil of Russia, used in the manufacture of Russian leather, and from which it derives its well-known fragrant odour, and its power of withstanding the attacks of insects and the progress of decay. This oil does not appear to be so well known as it deserves; it might probably be used for other purposes besides the preservation of leather; it is possible, likewise, that similar oils might be obtained by the destructive distillation of the bark of other trees.

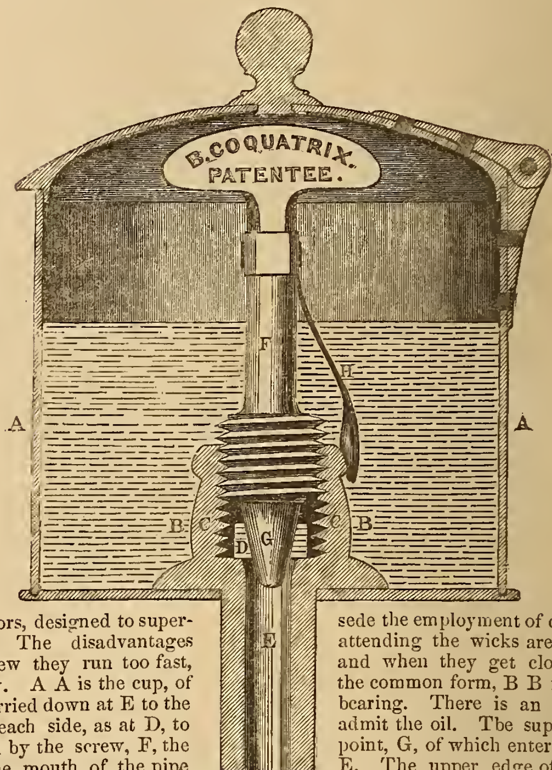
NOVELTIES.

Glyde's Improved Beer Valve.—The drawing of ale has long been a source of trouble to that useful body corporate the licensed victuallers, who have been puzzled to understand why the same engine which drew porter so well, should refuse to perform its office when applied to ale. This was attributed to the engine being out of order; but a more scientific investigation showed that the carbonic acid gas generated in the pipe leading from the butt in the cellar to the beer engine, having no vent, drove all the beer back into the butt. Thus, after a few minutes' rest, an attempt to draw beer only brings froth, and it is some time before a proper supply can be obtained. Mr. Glyde, gas-fitter, of Hastings, having experienced this difficulty, has remedied it by putting a valve at the bottom of the supply pipe, as shown in the accompanying engraving.



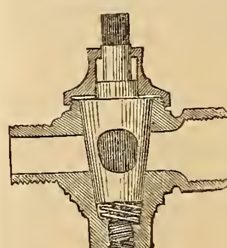
a is a small spindle valve, prevented from rising too high by a loose collar on the lower end of the spindle. This valve shuts, when the beer engine is out of action, and being air-tight, prevents the pipe, *c*, leading to the engine, from being emptied. *b* is the ordinary cock in the butt, from which a supply is being drawn. The valve, which is registered, is made complete in a valve box, so that it can be readily applied to the existing pipes.

Improved Lubricator.—Mr. Coquatrix has patented an improvement in



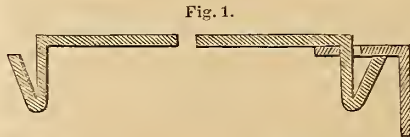
lubricators, designed to supersede the employment of cotton wicks. The disadvantages attending the wicks are, that when new they run too fast, and when they get clogged, too slow. A A is the cup, of the common form, B B is the pipe, carried down at E to the bearing. There is an opening at each side, as at D, to admit the oil. The supply is adjusted by the screw, F, the point, G, of which enters and closes the mouth of the pipe E. The upper edge of B B is milled, and affords a hold for the spring H, thus fixing the screw, and consequently the supply of oil, at any point desired.

Cressall's Improved Steam Cock.—The defects attaching to the ordinary cock, when used for high pressure steam, are well known. They leak, jam, and quickly wear out. These defects are attempted to be remedied in Cressall's Registered Steam Cock. The plug is screwed at its lower end, so that, as steam is turned on, the plug is raised from contact with the shell, and all friction avoided. The thread, in practice, we imagine, must be rather loose, as a helical spring is added at bottom of the plug to assist in raising it. The top of the plug is furnished with a stuffing box, to prevent leakage. We do not think this so good as the American form of stop-valve elsewhere described.



Fletcher's Improved Lath Fastening.—Messrs. G. Fletcher and Co., bedstead and hurdle manufacturers, of Wolverhampton, have registered an ingenious and simple method of fastening the wrought iron laths used in bedsteads. Fig. 1 shows the lath, one end of which is connected to the bedstead rail, and fig. 2 a plan of the same. The lath is broken in the centre. to save room. It will be observed that the rail is made with a slit in it, about the width of the lath. The ends of the laths are first bent into an acute angle, and then bent again into a right angle. When the ends of the lath are

Fig. 1.



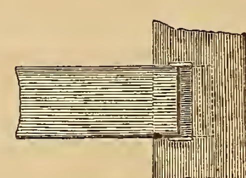


Fig. 2.

pressed into the rail, the acute angle collapses and allows the lath to enter; and when it has passed through the rail, it springs out, as shown in the sketch, and prevents the lath being withdrawn. To take the laths out, the ends must be compressed, to allow them to pass through the slits.

Rodd's Registered Filter-tap.—Having paid a tribute to beer, we must relieve our conscience, by noticing a remedy for the complaints of our water-drinking friends. We have often lamented the want of a cheap and good filter for the million, and we think we have now found it. Fig. 1 is an outside view of Mr. Rodd's filter, and fig. 2 is a section, about quarter size. It is of brass, tinned inside, to prevent the slightest contamination of the water; and is composed of three cylinders, the second one having a series of small holes, drilled laterally, near the bottom, through which the water enters the filter, which may be attached directly to the cistern or butt. The course of the water is shown by the arrows. The filter is filled with peat charcoal, or other approved material. When the filthy stuff supplied by the water companies is passed through one of these filters, it will pass out not only mechanically, but chemically purified, from the deodorizing and purifying power of the peat charcoal, as we have on previous occasions amply shown.

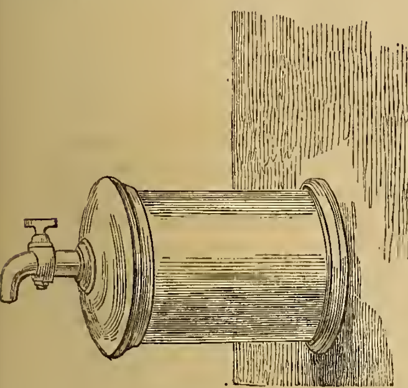


Fig. 1.

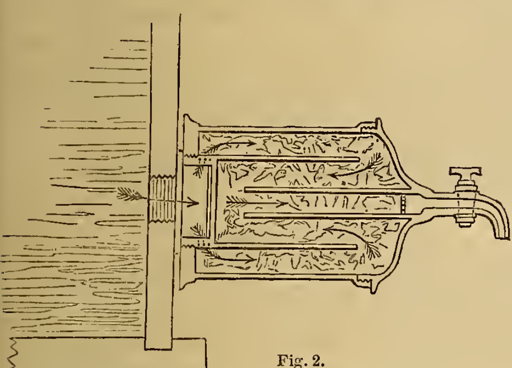


Fig. 2.

Railways in Denmark.—It has been decided by the Danish Government to form a railway between the towns of Flensburg and Husum, and thence to Tonningen and Rendsburg. The Lowestoft Steam Navigation Company have made the proposal of constructing a line, without fixing the Government to the payment of any interest on the capital, but in consideration of having the usual favourable conditions conceded to the Company, such as exemptions from duty upon all articles required for the construction of the line, &c. A period of 100 years has been named for the extension of the concession to be granted by the Government in regard to the undertaking. Besides opening the communication between the northern and eastern parts of the duchy of Schleswig, for the operations of commerce in a more direct manner between Sweden and Russia, by the establishment of steamboats at Flensburg, to run to Copenhagen, Stockholm, St. Petersburg, &c., the Company has in view, in an especial manner, the establishing quicker postal and passenger communication between England and Germany; having calculated that, as their steamboats can run from Lowestoft to Tonningen in 15 hours, while it generally takes from 45 to 50 hours for the Hull steamers to reach Hamburgh, many travellers will gladly avail themselves of the short run across from Lowestoft, and then avail themselves of the railway to the latter city, which will only take about four hours' time. One of the Lowestoft Company's boats, the *City of Norwich* steamer, arrived at Glückstadt a few days ago, in the short period of 28 hours; the shortest passage ever made.

American Axes in Canada.—The *Montreal Herald* states that a manufactory of American Axes has been established on the Lachine Canal by Messrs. Scott, Brothers, and Co. Their steel and iron are imported from England, and their coal from Pennsylvania. To balance the expense of importing coals, they have the tariffs both of the province and the United States. They have the provincial duty of 12½ per cent. against imported hardwares, and, instead of the 30 to 40 per cent. duty the United States imposes on British iron and steel, they have the nominal one of 2½ per cent.

The American axe, it is well known, is of a peculiar shape, curved in its outline, and very thick towards its edge, so that a section of it would not be an acute triangle, but the meeting at an acute angle of two curves. Its use is principally to fell the trees, and the object of its peculiar shape is, to clear itself when struck into the green wood, so as not to stick and require an effort to extricate itself, but to come out easily, and rather to recoil for another blow.

Another Rat-Trap.—Mr. John T. Vedder, of Schenectady, N.Y., has taken measures to secure a patent for a new and improved rat-trap; one, it is said by some, that will make the rats scarce wherever used. This rat-trap not only makes the rat catch himself, but drown himself at the same time; and, more than that, he adds rat-murder to rat-suicide, for, in the act of making his own fate, he resets the trap for another rat, without so much as leaving a solitary line of warning—like that which used to be on the old Schenectady canal packets, viz.,—"Passengers are requested not to stand on deck, under the penalty of being knocked down, killed, and drowned by the bridges."

Artificial Noses and Ears are now made of India-rubber. Artificial hands, &c., are also made. It is generally believed, that India-rubber will never be required to supersede the material of which the great number of consciences are made.—*Scientific American.*

Engineer to the Clyde Trust.—The election of resident engineer, in place of the late Mr. Bremner, took place at Glasgow, on the 18th inst. The committee appointed to investigate the claims of the various candidates—thirty-seven in number—unanimously reported in favour of Mr. J. F. Ure, of London. Mr. Ure is a native of Glasgow, about thirty years of age, and has been employed by Mr. Kyle, and by Mr. Rendel, C.E. Mr. Collie, of Glasgow, was also proposed, but, on a division, Mr. Ure received 19 votes, and Mr. Collie 11.

NOTES FROM CORRESPONDENCE.

₊ We cannot insert communications from anonymous correspondents.

Sir E. McNeill's Experiment on Canal Tow-Boats.—Will you allow me to suggest to this gentleman that his experiments, as detailed at p. 109, would have been more to the point, had we been told the effective power by indicator, which the engines of the respective boats were exerting. To say that the pressure on the valve was 45 lbs. in one case, 49 in another, and 50 in a third, is mere child's play. Neither do I see any account of the consumption of fuel. It is to be hoped that these points are not to be overlooked in the "further report" alluded to.

C. E.

[*Erratum.*—We perceive that our printers committed the error of dating this report (p. 109) 1852, instead of 1851.]

How to use Coke for House Fires.—I have bought some coke from the gas works, but the servants won't use it, and my wife—(on second thoughts, I need not touch on that, as she will, perhaps, see it in the *Artizan*, and I should not like to hurt her feelings). Well, they say it puts the fire out, and all sorts of nonsense. What *are* we to do with it, for we have got the cellar full ?—C. H.

Our correspondent's dilemma admits of an easy solution. The coke being in its unsophisticated state, is doubtless in large lumps, which *will* put a moderate-sized fire out, by a sort of negative process; that is to say, they will not readily ignite. The remedy is, merely to break them up into pieces about the size of a large egg, which is easily done with a sharp-nosed hammer. The retail dealers in coke do this, and it pays them well for the trouble; for a bushel of large coke will make a bushel and a half of small.

Rotary Engines.—"J. P. P." wishes to know what are the defects of rotary engines, as hitherto constructed, and what are the points required to make one suitable for locomotive and marine engines. We fear the answer would not be a very encouraging one; but we will say something on this point next month.

"H. F." is thanked for his reminder. Try Mr. Weale.

"M. Bosscha."—The experiments of Mr. Whitelaw on the centrifugal pump, are fully recorded in the *Artizan* for 1846-7 and 8.

Books Received.—"The Rifle;" "Exhibition Lectures, delivered at Society of Arts;" "Loss of the *Orion*," 2nd edition; "Guide to Photography;" "Lecture on Electro Metallurgy."

LIST OF ENGLISH PATENTS,

From the 24th of April to the 17th of May, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Samuel Heseltine, the younger, of Harwich, Essex, gentleman, for improvements in engines to be worked by air or gases. April 24.

William Church, civil engineer, and Samuel Aspinwall Goddard, merchant and manufacturer, and Edward Middleton, manufacturer, all of Birmingham, for improvements in fire-arms and ordnance, and in projectiles to be used with such or the like weapons; and also improvements in machinery or apparatus for the manufacture of part or parts of such fire-arms, ordnance, and projectiles. April 24.

Armand Jean Baptiste Louis Marceschean, of Rue de Moscow, Paris, France, gentleman, for improvements in the mode of conveying letters, letter-bags, and other light parcels and articles. April 24.

Richard Christopher Mansell, of Ashford, Kent, for improvements in the construction of railways, in railway rolling-stock, and in the machinery for manufacturing the same. April 24.

William Exall, of Reading, Berks, engineer, for improvements in the process, composition,

or combination of materials, machinery, and apparatus for making bread and biscuits, part of which machinery is applicable to the mixing and kneading of plastic substances in general. (Partly a communication.) April 27.

Alfred Taylor, of Warwick-lane, London, and Henry George Frasi, of Herbert-street, North-road, Middlesex, for improvements in heating and supplying water for baths and other uses, in the construction of water-closets, and in supplying them with water, and in cocks for drawing off liquids. April 27.

William Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery for weaving, colouring, and marking fabrics. (Being a communication.) April 28.

Thomas Richardson, of Newcastle-upon-Tyne, for improvements in treating matters containing lead, tin, antimony, zinc, or silver, and in obtaining such metals or products thereof. April 28.

Charles Fisher, of South Hackney, Middlesex, for improvements in transferring ornamental designs on to woven or textile fabrics, and in the apparatus connected therewith. April 29.

John Lintorn Arabin Simmons, of Oxford-terrace, Hyde-park, Middlesex, Captain in the Royal Engineers, and Thomas Walker, of the Brunswick Ironworks, Wednesbury, Stafford, Esq., for improvements in the manufacture of ordnance, and in the construction and manufacture of carriages and traversing apparatus for manœuvring the same. April 29.

Peter Bruff, of Ipswich, Suffolk, civil engineer, for improvements in the construction of the permanent way of rail, tram, or other roads, and in the rolling stock or apparatus used therefor. April 29.

James Fletcher, of Leyland, Lancaster, bleacher, for improvements in machinery or apparatus for stretching and dyeing woven fabrics. April 29.

John Hinks, of Birmingham, manufacturer, and Eugene Nicolle, of Birmingham, civil engineer, for a new or improved composition, or new or improved compositions, and machinery for pressing or moulding the same, which machinery is also applicable for moulding or pressing other substances. April 29.

George Goodman, jun., of Birmingham, Warwick, manufacturer, for an improved method, or improved methods, of ornamenting japanned metal and papier maché wares. April 29.

Stewart M'Glashen, of Edinburgh, Scotland, sculptor, for the application of certain mechanical powers, for lifting, removing, and preserving trees, houses, and other bodies. April 29.

John Robinson, of Rochdale, Lancaster, timber-merchant, for improvements in machinery or apparatus for shaping wood into mouldings and other forms. April 29.

John Cumming, of Paisley, Renfrew, North Britain, pattern designer, for improvements in the production of surfaces for printing or ornamenting fabrics. April 29.

Alexander Parkes, of Pembrey, Carmarthen, chemist, for improvements in obtaining and separating certain metals. May 1.

Hugh Lee Pattinson, of Scot's-house, near Newcastle-upon-Tyne, manufacturing chemist, for improvements in smelting certain substances containing lead. May 1.

John Moore, of Arthur's Town, Wexford, for improvements in nautical instruments applicable for ascertaining and indicating the true spherical course and distance between port and port. May 1.

James Johnson, of Waterloo-place, Kingsland, Middlesex, hat-manufacturer, for certain improvements in the manufacture of hats. May 1.

Thomas Mosdell Smith, of Hammersmith, gentleman, for improvements in the manufacture of wax candles. May 1.

William Wood, of Pontefract, York, carpet manufacturer, for improvements in the manufacture of carpets and other fabrics, and in apparatus or machinery connected therewith. May 1.

Charles Thomas, of Bristol, soap manufacturer, for improvements in the manufacture of soap. May 1.

Edward Gee, of Liverpool, merchant, for improvements in apparatus for roasting coffee and cocoa. May 1.

Henry Bridson, of Bolton, Lancaster, bleacher, for improvements in machinery for stretching, drying, and finishing woven fabrics. May 1.

Augustus Siebe, of Denmark-street, Soho, Middlesex, engineer, for improvements in machinery for manufacturing paper. (Being a communication.) May 1.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of printing surfaces. (Being a communication.) May 1.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, Middlesex, patent agent, for improvements in paddle-wheels. (Being a communication.) May 4.

Richard Jordan Gatling, New York, for certain improvements in machinery for seeding grain. May 4.

George Robins Booth, of the Wandsworth-road, Surrey, for improvements in the manufacture of gas. May 8.

George Frederick Muntz, jun., of Birmingham, for improvements in the manufacture of metal tubes. May 8.

Joseph Jepson Oddy Taylor, of Gracechurch-street, London, naval engineer, for improvements in ships, boats, and vessels, and in certain articles of ships' furniture. May 8.

William Littell Tizard, of Aldgate High-street, London, brewers' engineer, for improvements in machinery, apparatus, and processes for the preparation of grain, and for its conversion into malt, saccharine, vinous, alcoholic, and acetous liquors. May 8.

Alexandre Jules Saillant, jun., of the Rue Vivienne, Paris, tailor, for certain improvements in the manufacture of articles of dress. May 8.

John Campbell, of Bowfield, Renfrew, N. B., bleacher, for improvements in the manufacture and treatment or finishing of textile fabrics and materials, and in the machinery or apparatus used therein. May 8.

William Gillespie, of Forbane-hill, Linlithgow, Scotland, gentleman, for an improved apparatus, instrument, or means for ascertaining or setting off the slope or level of drains, banks, inclines, or works of any description, whether natural or artificial, or under land or water. May 8.

William Armitage, of Manchester, for an improved safety envelope, and certain improvements in the machinery to be used in the manufacture of the same. May 8.

Peter Fairbairn, of Leeds, York, machinist, and Peter Swires Horsman, of Leeds aforesaid, flax-spinner, for certain improvements in the process of preparing flax and hemp for the purpose of heckling, and also machinery for heckling flax, hemp, China grass, and other vegetable fibrous substances. May 8.

Samuel Hall, of Manchester, Lancaster, agent, for certain improvements in the construction of cocks, taps, or valves. May 17.

George Frederick Parratt, of Piccadilly, for improvements in life-rafts. May 17.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the construction of docks, basins, railways, and apparatus connected therewith, for raising or removing vessels or ships out of the water, or on to dry land, for the purpose of preserving or repairing the same. (Communication.) May 17.

LIST OF SCOTCH PATENTS,

From 22nd of March to the 22nd of April, 1852.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, patent agents, for improvements in presses and pressing, in centrifugal machinery, and in apparatus connected therewith, part or parts of which are applicable to various useful purposes. (Communication.) March 24.

Colin Mather, of Salford, Lancaster, machine-maker, and Ernest Rolffs, of Cologne, Prussia, gentleman, for improvements in printing, damping, stiffening, opening, and spreading woven fabrics. March 24.

James Melville, of Roebank Works, Lochwinnoch, Renfrew, calico printer, for improvements in weaving and printing shawls and other fabrics. March 29.

Alexander Forfar, of Milnathort, Kinross, builder, for improvements in ventilation, and the prevention of smoky chimneys. March 29.

Joseph Jones, of Bilston, Stafford, furnace-builder, for certain improvements in furnaces and in the manufacture of iron. March 29. Four months.

Sir John Scott Lillie, of Pall-mall, Companion of the Most Honourable Military Order of the Bath, for certain improvements in the construction and covering of roads, floors, walls, doors, and other surfaces. April 2. Four months.

William Watson Pattinson, of Felling New House, Gateshead, manufacturing chemist, for improvements in the manufacture of chlorine. April 2.

George Mills, of Southampton, Hants, engineer, for improvements in steam-engine boilers, and in steam-propelling machinery. April 2.

Alexandre Hédiard, of Rue Taitbout, Paris, gentleman, for certain improvements in rotary steam-engines. April 5.

Joseph Pimlott Oates, of Lichfield, Stafford, surgeon, for certain improvements in machinery for manufacturing tiles, quarries, drain-pipes, and such other articles as are or may be made of clay or other plastic substances. April 6.

Russell Sturgis, of Bishopsgate-street, London, merchant, for improvements in weaving looms. (Communication.). April 8. Four months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, patent agents, for certain improvements in the treatment and preparation of fibrous and membraneous materials, both in the raw and manufactured state, in applying electro-chemical action to manufacturing purposes, and in the manufacture of saline and metallic compounds. (Communication.) April 10.

Thomas Barnett, of Kingston-upon-Hull, grocer, for improvements in machinery for grinding wheat and other grain. April 13.

Charles William Siemens, of Birmingham, engineer, for an improved fluid meter. April 15.

Richard Roberts, of Manchester, Lancaster, engineer, for improvements in machinery or apparatus for regulating and measuring the flow of liquids, also for pumping, forcing, agitating, and evaporating fluids, and for obtaining motive power from fluids. April 16. Four months.

William Whittaker Collins, of Buckingham-street, Adelphi, civil engineer, for certain improvements in the manufacture of steel. April 16. Four months.

John Hack Winslow, of Troy, New York, United States, iron-master, for improvements in machinery for blooming iron. April 16.

William Hyatt, of Old-street Road, engineer, for improvements in applying and obtaining motive power. April 16.

Martyn John Roberts, of Woodbank, Gerard's-cross, Bucks, Esq., for improvements in galvanic batteries, and obtaining chemical products therefrom. April 19.

François Joseph Beltzung, of Paris, engineer, for improvements in the manufacture of bottles and jars of glass, clay, gutta percha, or other plastic materials, and caps and stoppers for the same, and in pressing and moulding the said materials. April 19.

John Walton le Longueville Giffard, of Serle-street, Lincoln's-inn, barrister-at-law, for improvements in fire-arms and projectiles. April 19.

William Gorman, of Glasgow, Lanark, engineer, for improvements in obtaining motive power, which improvements, or parts thereof, are applicable to measuring and transmitting aëriform bodies and fluids. April 20.

LIST OF IRISH PATENTS,

From 21st of March, to the 19th of April, 1852.

Thomas Barnett, of Kingston-upon-Hull, York, grocer, for certain improvements in machinery for grinding wheat and other grain. March 22.

Russell Sturgis, of Bishopsgate-street, London, merchant, for improvements in weaving looms. (Communication.) March 31.

Alexandre Hédiard, of Rue Taitbout, Paris, gentleman, for certain improvements in rotary steam-engines. March 31.

Henry Bernouilli Barlow, of Manchester, Lancaster, consulting engineer, for improvements in preparing and dressing hemp and flax, and in the machinery employed therein. April 5.

DESIGNS FOR ARTICLES OF UTILITY.

From 22nd of April to the 20th of May, 1852.

April 22, 3224, I. Firkins and Co., Worcester, "Gloves."
„ 22, 3225, F. Ayckbourn, Guildford-street, Russell-square, "Apparatus for supporting persons in the water."
„ 23, 3226, W. M'Lennan, Glasgow, "Apparatus for moulding and attaching shoe-soles."
„ 23, 3227, C. Farrow, Great Tower-street, "Self-closing valve."
„ 23, 3228, C. Baker, Rotherfield-street, Islington, and W. G. Gardiner, Wellisford, Somersetshire, "Fire-escape, or servant's safety-guard."
„ 24, 3229, J. Murphy, Newport, Monmouthshire, "Tyre for wheels."
„ 24, 3230, T. K. Baker, Fleet-street, City, "Lever-cock or hammer for fire-arms."
„ 26, 3231, F. Mason, Ipswich, "Reaping-machine."
„ 27, 3232, J. B. Palmer, Wednesbury, "Mould for projectile."
„ 28, 3233, L. N. Le Gras, Tennison-street, Lambeth, "Aërated liquor bottle-stopper."
„ 29, 3234, Hargrave, Harrison, and Co., Wood-street, Cheapside, "Parasol-cane."
„ 30, 3235, W. I. H. Rodd and Co., Little Newport-street, "Filter-tap."
May 1, 3236, J. Graham and J. James, Birmingham, "Carpet-bag."
„ 1, 3237, G. Fletcher and Co., Wolverhampton, "Portable bedstead."
„ 3, 3238, C. Maschurtz, Birmingham, "Match-box."
„ 3, 3239, Morris and Son, Astwood Bank, near Redditch, "Needle-case."
„ 3, 3240, 3241, A. Stuart, Edinburgh, "Script type, to be called 'The American mercantile script.'"
„ 5, 3242, L. Glyde, Hastings, "Air-tight valve for beer-engines."
„ 5, 3243, M. Buck, Skeyton, Norfolk, "Currant dressing-machine."
„ 7, 3244, G. Holcroft, Manchester, "Steam-boiler."
„ 7, 3245, S. Woodbourne, Liss, "Horse-rake."
„ 10, 3246, W. Dray and Co., London-bridge, "Right-and-left-hand hill-side plough."
„ 11, 3247, A. Marion and Co., Regent-street, "Combined pen-cleaner and stopper."
„ 12, 3248, J. Winterbottom, Yorkshire, "Jar and bottle-stopper."
„ 12, 3249, R. Marples, Sheffield, "Pad for joiners' brace."
„ 12, 3250, G. Thonger, Northampton, "Fly-catcher."
„ 14, 3251, Fowler and Fry, Bristol, "Brick-die."
„ 14, 3252, G. Walsh, Halifax, "Beer-engine suction."
„ 14, 3253, E. Cockey and Son, Frome, "Heating boiler."
„ 17, 3254, R. W. Savage, St. James's-square, "Invisible door-spring."
„ 17, 3255, T. Beckett, Manchester, "Spindle-gauge."
„ 18, 3256, Callius, Brothers, Birmingham, "Crayon-holder."
„ 19, 3257, F. Richmond and P. Chandler, Salford, "Chaff-machine."
„ 19, 3258, Guest and Chrimes, Rotherham, "Water-closet service-box."
„ 19, 3259, T. D'Almaine and Co., Soho-square, "Hopper escapement for pianoforte."
„ 20, 3260, P. A. L. de Fontainemoreau, Finsbury, "Self-indicating altometer."
„ 20, 3261, E. Williams, George-street, Borough, "Machine for making rolled balls of boiled sugar."

IMPROVED TURN TABLE.

By Mess.rs Dunn, Hattersley & C.o Manchester.

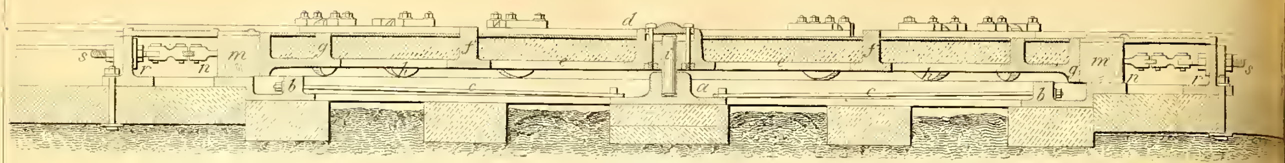


Fig. 1.

Fig. 3.

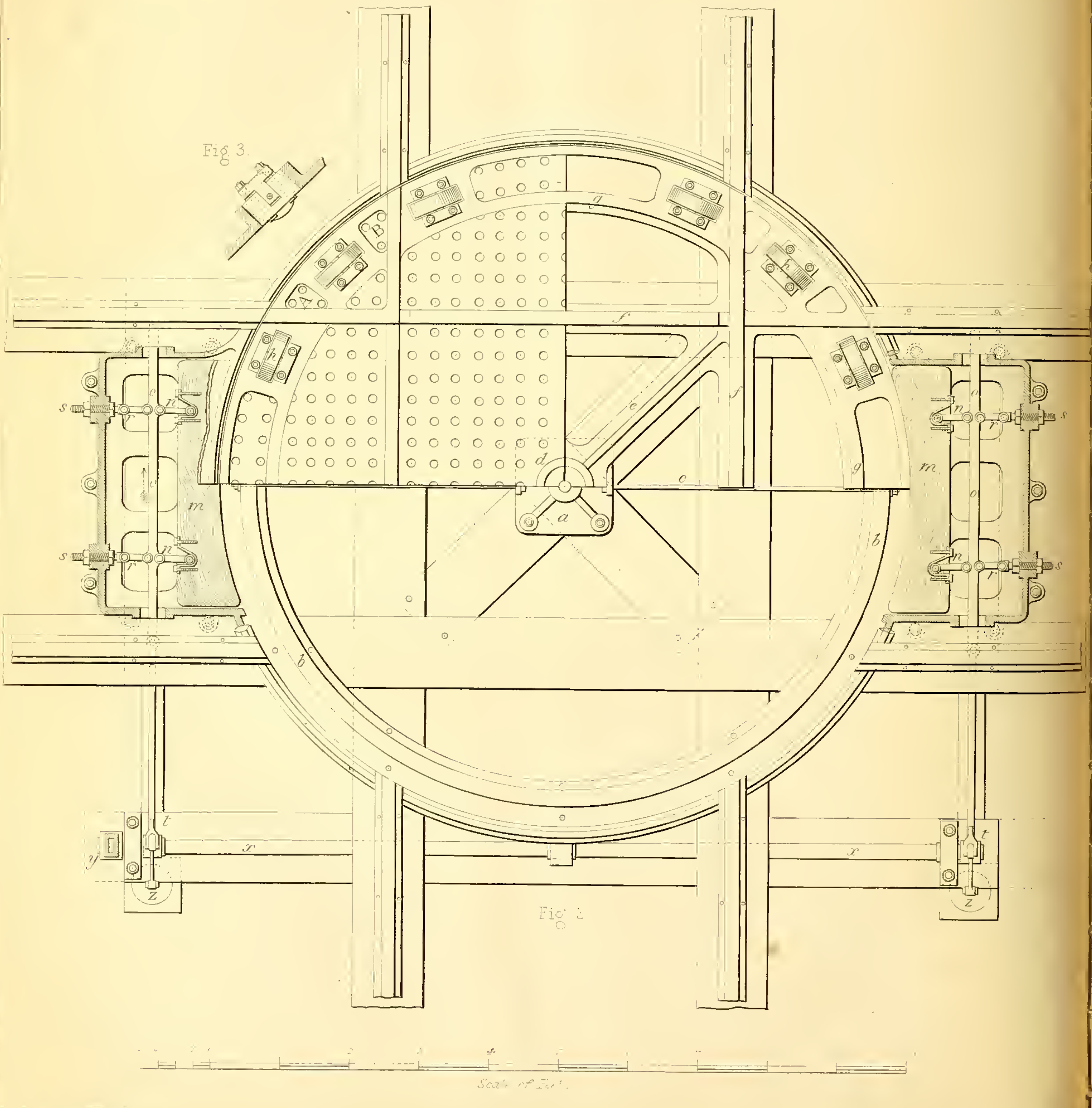
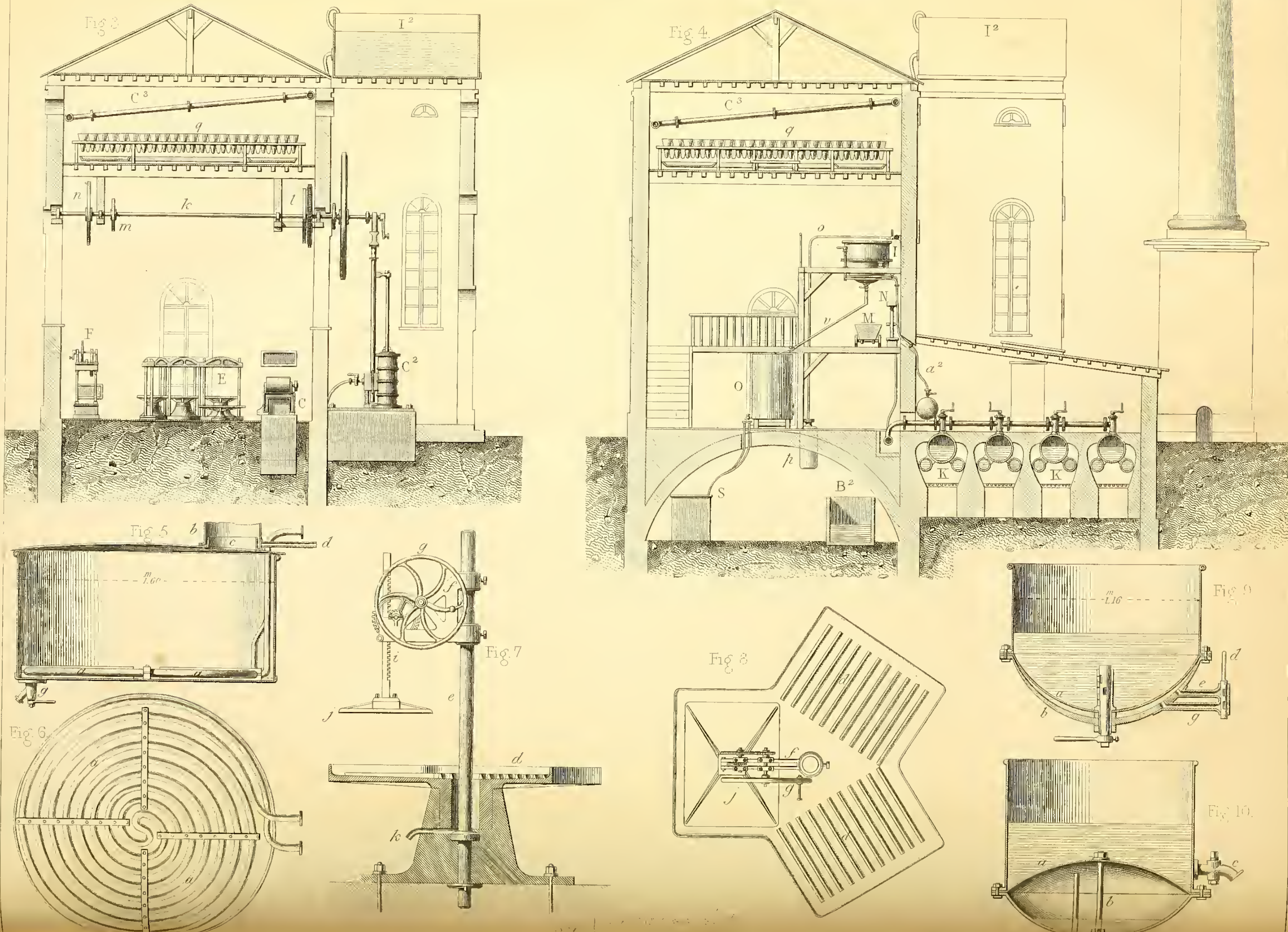


Fig. 2.

Scale of Feet.

BEET SUGAR FACTORY BY M. DEWILDE.



THE ARTIZAN.

No. VII.—Vol. X.—JULY 1st, 1852.

THE EVENTS OF THE MONTH.

Under the head of "Events of the Month," we propose, in future, to give a brief notice of those current events to which, from their importance, it may be desirable to call our readers' attention.

We may congratulate our readers, in the first place, on the passing of the Patent Law Amendment Bill, which was read a third time on the 23rd instant, and comes into operation on the 1st of October next. Immediate protection, division of payments, and reduction of fees, are the leading characteristics of the new bill, which only requires a Board of Examiners to make it work well. The immediate consequence will be, a rush of inventors to the Patent Office, and a waste of money and time in re-patenting exploded schemes, which is fearful to contemplate. It would not be necessary to give a Board the power of putting a *veto* on a patent; their duty might be confined to pointing out to the applicant what had been done by other patentees, and leave him his choice to amend, proceed, or withdraw. The commissioners have the power of publishing not only future, but all previous specifications. The Augean stable of the Patent Office requires a Hercules, indeed, for its purification. The provisions of the act will be found at another page. The clause requiring a world-wide novelty has been rejected.

Individuals are proverbially unfortunate who do not know what to do with their money; and if this hold good with nations, we are at the present moment being punished by a stream of gold pouring in upon us, for which we can find no employment. We are told, that in America, the mighty Mississipi cuts annually for himself fresh channels through the forests, and that a paternal government clears away the timber in the direction the flood is likely to take, to prevent those trees being converted into snags —the terror of the steam-boats. Can any sagacious individual point out to us the course which the golden stream is likely to take? Is it to the railways, steamboats, submarine telegraphs, canals, mines, or colonisation? We must look to the Press to clear away the snags, in whichever direction the stream flows.

Amongst railways, the Madras line promises well. It has several large towns and a large population, on eighty miles of length, may be constructed cheaply, and there is no competing water-carriage. The line is to be a single one at first, and the East India Company guarantee 4½ per cent. interest on the cost. The other Indian railways are progressing satisfactorily. At home we have to notice an attempt on the part of the North Western Railway Company to increase the speed of their express trains. It is said that Messrs. Fairbairn, of Manchester, have guaranteed to build engines to do the distance between London and Birmingham, 112 miles, in two hours. There have been several fatal accidents, but we do not find that they have been the means of inducing any of the companies to adopt the mechanical appliances by which they might be prevented, and which we have repeatedly pointed out.

The commercial world is doomed to suffer for another session the monopoly of the old Electric Telegraph Company; the British Telegraph Company having been thrown out on standing order. The Irish submarine telegraph has been completed by the energy of Messrs. Newall and Gordon, and various other lines are being matured.

The Crystal Palace Company have secured the co-operation of the Brighton Railway Company, and promise us the building with a raised arched nave the whole length, and a transept twice the height of the present one, ready by May, 1853. Of the pecuniary success of a permanent exhibition of this kind many people doubt. This we may predict—that its aim must be the practical education of the masses, if it is not to become a mere summer promenade. The South Western and Brighton lines are to be joined, to bring the West-end traffic; and if the approaches to the Thames Tunnel are completed as proposed, a line might be carried through it, connecting the Eastern Counties, Blackwall and Brighton lines.

New railways have become rare; one—the Plymouth and Tavistock—has announced its determination not to proceed unless it meets with entire local support, and not to have a London engineer. Self-reliance is a great virtue, but may be carried too far; and we trust their engineer will do better than the gentleman who laid out the Hayle line, and who, after excavating through hard rock, had to fill it up again, through an error in his levels.

Several mining companies are in the market, amongst which we may mention the Connemara Mining Company, who propose to work copper and silver lead mines in Galway. They state in their prospectus that other Irish companies have paid 10 to 25 per cent. There have been some failures, however—the Arigna Company, to wit. There are also the Arundel United Copper Mines at Ashburton, Devon, and the Britannia at Molton, said to be a second Ophir, with what truth time will soon show. The North Wales Consolidated Mining Company have just issued a prospectus, as also the New South Wales Gold Mines Company, who have taken advantage of a hint of Professor Tennant's, and have determined to find diamonds as well as gold. For various other companies offering an investment for capital we must refer to our list at another page.

The rapid extension of steam navigation is a remarkable feature at the present moment. The outward and homeward voyages of the *Great Britain* have surpassed the expectations even of those who knew what Mr. Penn could do. The new West India mail steamers are a complete failure, as compared with this vessel, and it has been evident to us for some time, that unless this company make some radical change in their system, their monopoly will not be much longer endured. The mails, which they are paid an enormous sum to convey, are regularly anticipated by those *viâ* New York, and the public will demand a change, without stopping to inquire into the precise grounds of failure.

The question of the relative advantages of the Pacific and Cape routes to Australia, so ably argued before the Committee of the House of Commons (see our *Analysis of the evidence on steam to Australia*, Artizan, 1851), is about to be tested by the Pacific and Australian Steam Navigation Company, who, in all probability, will secure good freights of bullion and gold-diggers. The *Australian*, for Australia, *viâ* the Cape, and the *Queen of the South*, for India, have just left—the pioneers of a fleet of screw steamers which will soon cover the Eastern seas. Some of our large shipowners are looking out for screw engines for their vessels. They will find nothing better than those shown in our last volume, if fitted with a separate engine for working the air-pump. The North of Europe Company are about extending their operations, which have hitherto been confined to the traffic between Lowestoft and Denmark. A monster steamer is talked of, for bridging the Irish Channel, at 25 miles an hour. We have a dislike

to monsters. The last one heard of, for the Peninsular and Oriental Company, after making a very good scarecrow for the Eastern Companies' opposition (now defunct) has turned out very like a whale. It is idle to talk about the *possibility* of it. A tunnel between Dover and Calais is quite possible, and would pay better. Ireland cannot *afford* to pay for 25 miles an hour, for some years to come. When 16 knots an hour was mentioned for Atlantic steaming, we took the liberty of expressing our dissent in the *Times;* and nobody cared to tackle the figures. Something more practical for Ireland is the Cork Exhibition; which, if we had not been satiated with *The* Exhibition, would have been the lion of the season. As it is, it cannot fail to do a great deal of good, and will stimulate local exhibitions, which will pave the way for mechanics' institutes, schools of design, public parks, and the like.

IMPROVED TURN-TABLE,

BY MESSRS. DUNN, HATTERSLEY, AND CO., WINDSOR-BRIDGE IRON-WORKS, MANCHESTER.

(Illustrated by Plate 10.)

The improvements which Messrs. Dunn, Hattersley and Co., have effected, and which have been protected by registration, consist, firstly, in arranging the friction-rollers so as to admit of their being more readily adjusted; and, secondly, in adding a break, so that the momentum of the table and the engine or carriage upon it can be arrested, without the concussion inseparable from the ordinary turn-table, which is abruptly stopped by drop-catches.

In plate 10, drawn to a scale of ½ inch to a foot, fig. 1, is an elevation in section of the turn-table; fig. 2, a plan of the same partly in section; and fig. 3, a section through A B, showing one of the bearings of the friction-roller.

The table is shown fixed on wood-sleepers, and consists of a central boss, *a*, attached to the outer ring, *b b*, by tie-rods, *c c*, which have T heads, dropping into projections on the centre boss, *a*. The moving portion of the table consists of a boss, *d*, the arms, *e e*, the cross rails, *f f*, and the rim, *g g*. To the rim are attached the rollers, *h h*, &c., which run on the ring, *b b*, and the bearings of which are dropped into recesses cast in the rim on the upper side, so that they are accessible. The bearings of each roller are carried by four bolts, by screwing or unscrewing which the adjustment of the table is effected. The rollers are arranged in such a position as to take the weight with least strain to the table.

The centre of the table is carried by a pin, *i*, on which rests a cap, bolted to the table, so that by turning these bolts, its height can be adjusted. Nuts for these bolts are let into the under side of the boss.

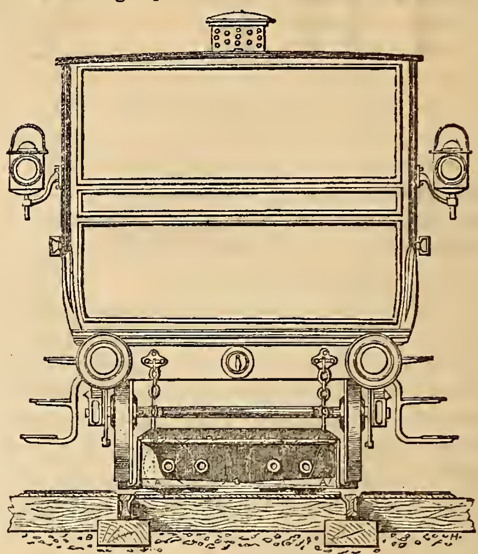
The brake apparatus is similar in principle to that in use for railway carriages. The table is embraced on two opposite sides by wooden friction blocks, to which motion is given through toggle joints.

m m are the wooden blocks, curved to suit the periphery of the table, and connected by the links, *n n*, to the bars, *o o*. These bars are also connected by the links, *r r*, to the adjustable fixed bolts, *s s*, which form the *fulcra* for the action of the brakes. The bars are actuated by the levers, *t t*, on the shaft, *x*, to which is attached a handle, *y*. The arrows show the direction in which the handle and levers are moved to bring the brakes on the table.

z z are balance weights, to bring back the brakes when the hand is removed from the handle.

In this manner a most complete command is obtained over the motion of the table, as it can be stopped at any point, whilst the absence of concussion will materially promote its durability and diminish the cost of repairs.

We take this opportunity of also noticing Mr. Dunn's most ingenious invention of the "Patent Traverser," by means of which a carriage can be shifted from one line of rails to another with wonderful ease and rapidity. A line of rails is laid down transversely to the main line, and on it runs the traverser, which is a low truck, shown in end view with a carriage upon it, in the accompanying engraving. This traverser



has shelves at the sides, on which the carriage is run, and the flanges of the carriage wheels being raised by the inclination of the shelves, clear of the main line, the carriage can be shifted sideways any distance that may be required. A great advantage which this plan possesses over turn-tables, is, that it leaves the main line, over which trains have to pass at full speed, unbroken and firm. It will be observed that the traverser is carried by four wheels at each end, and that they are arranged in pairs, as near each other as their diameter will permit. This is designed to prevent a wheel sinking into the space necessarily left in the rails to allow the flanges of the wheels to pass, and which would occasion a very undesirable concussion. The traversers have now come into very general use, and they are made either of cast or wrought iron, according to the class of work they are intended for. We are glad to see that this very simple and original invention was rewarded with a council medal at the Great Exhibition.

ON RECLAIMING LAND FROM THE SEA.*

(Concluded from page 129.)

Having disposed of the question of materials, the next important point is the best form to be given to them. As it is evident that different portions of the bank have to sustain varying pressures, it is divided into three sections.

1st. *The main bank*, built to the full height of ordinary spring tides, which is taken, by way of example, at 10 feet. It is 20 feet wide at top, and with a slope to sea side, partly of 5 feet base, and partly of 4 feet base, to 1 perpendicular, as the minimum slopes.

2nd. *The outburst bank*, 5 feet high and 8 wide at top, and with a slope of but 1½ to 1, because this part of the bank will have to sustain but a transient stress from the top of the tide, and this only occasionally.

On this is set

3rd. *The swash bank*, which having only to sustain the broken tops of the waves is but 2½ feet high and 2½ feet wide at top, though its base is 8 feet, and should be made amply sufficient to prevent any part of the highest seas going over the bank.

From these rules, the reader may easily set out a section of a bank for himself. The slope at the back, landward, when of good earth, may be 1 to 1.

The facing of the wall is the next point. If of sand, it should first have a facing of clay, before the stone is laid on. Flaggy stones must be pitched endways (not flat), but when massive, like Kentish rag stone, "12 to 15 inches in thickness, or less, will suffice; and there is

* *The Practice of Embanking Lands from the Sea.* By John Wiggins. F.G.S. London: Weale. Rudimentary Series.

no better way than placing them side by side till the surface is covered, taking care to entangle and hitch the angles of each stone with those of its neighbours; then, by encouraging such maritime plants as the soil of the bank will produce, the interstices between the stones are much better occupied than by a continuous mass of stone, since the roots below interlace and keep the stones in place, and the vegetation at top eases off the wave and renders it innoxious."

Stone, however, is too expensive a material to be employed for the whole face. To face with stone up to high water at spring tides is sufficient in all but very exposed situations. Couch, sand rush (*arundo arenaria*), and lucerne, are well adapted, from the binding nature of their roots, for the purpose of covering the bank.

When there is any traffic along the beach at low water, it may be made to assist in preserving the base of the wall, by laying down on the mud a coating of gravel. This is consolidated by the traffic, and forms a good natural sea-beach.

It is of the utmost importance that the back of the bank should be well swarded, because, in the event of the sea coming over the bank, its effect is to "peck it away" from *the back*, and eat it through, as happened with the Holmfirth Reservoir (*vide* p. 81).

A *delph* or drain is dug along the back of the bank, and should not be too near, or it will affect its stability. About 12 yards from the foot is stated to be the true distance. Its usual dimensions are 12 feet wide at top, 6 feet at bottom, and 4 or 5 feet deep, and it generally contains 3 or 4 feet of water, to form a fence for cattle. These dimensions are exceeded when the soil is required for making the bank, but it is only in strong soil that this is admissible.

During the process of forming the bank, all the appliances of modern practice may be brought to bear, as time is an important element in the cost. If it be too slowly laid, the material may be washed away as quickly as it is deposited. The operation of shutting up the two ends of the banks requires considerable judgment, as it must be done in one tide. Sometimes, two gaps are preferable to one.

If any streams run through the intake, the author recommends that they be not enclosed, as they are liable to give trouble in winter when they are swollen. This, of course, necessitates an additional length of bank. Another precaution is to let the earthwork remain, for one winter, without any stone facing, till it is seen what effect the sea has upon the bank, and what slope it *takes*.

The best line of direction for the bank is important. It should run in a line with, rather than at right angles to, the prevailing winds and seas, and with a few projecting elbows, which must be well protected at their salient points, and will thus cause the bays to silt up and so defend the foot of the bank.

If the intake is to be drained by gravitation simply, the foot of the bank should be 4 feet above low water mark, so as to allow of 6 hours' run between tide and tide. This, however, can scarcely be obtained for the whole of the intake, and a small portion of it may be required to be drained by steam power.

The eligibility of the site depends upon the facilities which it offers for the construction of the bank, and upon the nature of the soil.

"The best and earliest indication when a marine soil has become fit to embank is the growth of samphire, which demonstrates its stability and permanence of position, and is the forerunner of the marine grasses, so healthy for sheep, which are largely fed on the very extensive saltings of Essex, care being taken at first to drive them off as the tides put on, though they soon learn to come off themselves, before the filling of the creeks prevents their escape."

The drainage and reclamation of the intake form a subject to which we may refer our agricultural readers with much advantage. The course to be adopted, is quaintly summed up as follows:—"1, To freshen gradually; 2, to drain effectually; 3, to cultivate perfectly; 4, to crop moderately; 5, to look to grazing ultimately; 6, to lay down to grass carefully." The freshening process, it may be mentioned, depends for its duration on the rapidity with which the drains are deepened, which, from the flow of water they induce, cause the saline particles to be washed out of the land.

The cost of embankment, as may be presumed, varies very much according to locality and circumstances. Taking the case of an intake of 1000 acres, where the distance for the materials to be carried is about a mile from the shore on each side, and about the same to the gap left for shutting up, the price, according to various railway engineers' estimates, should be 9*d*. per cubic yard. Allowing for the smaller scale of work, loss of materials, night work, bad weather, &c., 1*s*. per yard may be considered perfectly safe for all materials brought from a distance.

The materials in a bank of the dimensions previously given, having contents of 60 cubic yards per yard linear, would cost 10*d*. per yard. Allowing one-third to be raised on the spot at 6*d*., and the rest to be brought from a distance at 1*s*., but, for safety, taking 1*s*. for the whole, we have £5,280 per mile. But this supposes that the whole bank is of these dimensions, which is very improbable. On an average, £3,000 per mile may be taken, to which must be added the facing of stone, a safe estimate for which is £1,000 per mile. The estimate of cost will therefore stand as follows:—

4 sluices of 3 feet run, each at £150	£600
Steam power, say	500
600 rods of catch-water drains, at 5*s*.	150
$3\frac{1}{2}$ miles of circular drain and fence, at 4*s*. per rod ..	250
Gripping (surface drains), at $1\frac{1}{2}$*d*. or 2*d*. per rod ..	500
Total on 1,000 acres	£2,000
Cost of $3\frac{1}{2}$ miles of bank	15,750
Contingencies, management, &c.	2,250
	£20,000

being the cost of 1,000 acres ready for culture.

When we know that land thus recovered is often worth from £30 to £50 per acre, it is obvious that there is a liberal margin for profit and accidental expenses. And this is necessary; for the opposition of vested interest has to be provided against by an act of Parliament. The rights of the "frontager" to feed a few sheep or cattle on the "skirts," assume a fresh importance, when he is to be deprived of his privilege by a company of adventurers, who are looked upon as fair game. Our author describes, with a sagacity natural to the old campaigner, the plan of operations for disarming opposition and securing good terms. One-fifteenth seems to be recognised as fair royalty for the adventurers to pay the frontager, which, at an average of £35 per acre, gives £2 6*s*. 6*d*. per acre, or 1*s*. 6*d*. per acre per annum. Thus our estimate will stand as follows:—

Value of 1,000 acres embanked and drained ..		£40,000
Cost of embanking and draining ..	£20,000	
„ of 1*s*. 6*d*. per acre, or $\frac{1}{15}$ ..	1,500	
„ Occupation roads, gates, &c. ..	1,500	
„ Parliamentary, professional, &c.	1,000	
„ Extra works	1,000	
		25,000
At £40 per acre, profit		15,000
At £35 „		10,000
At £30 „		5,000

Mr. Wiggins goes into some detail on the legal questions connected with obtaining the act of Parliament, for which we must refer to the work itself. The repairs of old sea-walls are treated of, and much in-

formation given as to the method of construction adopted on the Continent. On this point we may also refer our readers to the *Artizan*, vol. 1847, pp. 58, 78, 79.

Our readers will not fail to gather, from the sketch we have given them, that the author has brought to bear on his work extensive experience and sound practical judgment. It has the merit, moreover, of being written in a most unassuming spirit, to which alone we can attribute the fact, that we have never met Mr. Wiggins in print before.

COTTON AND ITS MANUFACTURING MECHANISM,

By Robert Scott Burn, M.E., M.S.A.

(Continued from page 120.)

In the lap machine, the cotton, after being acted upon by the beaters, is wound upon lap rollers. The cotton, after passing from the beater, passes up the inclined apron and between the rollers, *a b* (fig. 1.); it is next passed between the two pairs of rollers, *c c*, *d d*, the upper one of each pair being loaded. The two rollers, *e e*, revolving in the same

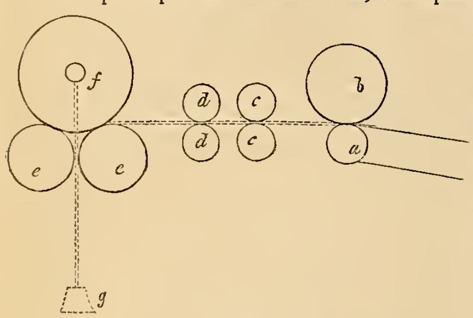


Fig 1.

direction, by their friction, cause the lap roller, *f*, to revolve: this lap roller is loaded by a link and weight, *g*. The cotton is passed from the last pair of rollers, *d d*, to the lap, *f*; round the surface of which it is wound. As it increases in diameter, it rises up, bringing with it the link and weight, *g*. As soon as there is a sufficient quantity of cotton on the roller, the rollers, *c c*, with their attendant apron, beaters, &c., are thrown out of gear; while the rollers, *d d*, continuing to revolve, the lap is necessarily torn across somewhere between the rollers, *c c*, *d d*. The attendant then raises the link and weight, *g*, by means of a lever, and releasing the lap roller from the weight, it is withdrawn, and an empty one put in its place, to be filled as before. In the "double beater lap machine" (a section of which will be given in the next No.), the rollers, thus filled by the lap machine, are placed in slotted bearings, their entire peripheries always remaining in contact with the endless apron. As the laps decrease in diameter, the axes of the rollers descend in the slotted bearings. The endless apron unwinds the lap and delivers it to the feed rollers, and from thence to the first beater, the dirt, &c., passing through the grating; the cotton is then passed up the incline, and from thence delivered to the second beater. It is finally passed to the apparatus which in the form of machine we have figured is known as the Patent Condenser; in which, by the use of a combination of rollers, as in the drawing, the cotton is much consolidated, and a larger amount is placed on a lap roller than is usually the case. From the arrangement of this machine at the feeding end, different varieties of cotton can be mixed, and finally wound upon the lap. Each lap roller revolving in contact with the feed-apron may be supplied with a different quality of cotton, and thus, by proper arrangements, in this respect, a quality may be finally obtained possessing in certain different proportions the distinguishing qualities or properties of each. From the great speed at which the beaters revolve, a sufficient current is produced to clear off a considerable quantity of the expelled dust; but, in order to do so effectually, special fanners are employed, as in the drawing. These withdraw the dust and floating impurities.

The drawing from which this section of "Blower" has been reduced, was furnished by Mr. John Mason, machinist, of Rochdale; to whose kindness we are indebted for numerous other machines used in the cotton manufacture, and which we purpose presenting to the notice of the readers of the "Artizan," from time to time.

The improvements yearly patented, in connection with blowing machines, are, like the other branches of cotton mechanism, very numerous. We shall very briefly notice two, the arrangements of which possess some novelty. The first is patented by Messrs. Fairbairn and Hetherington, of Leeds and Manchester, and is proposed as a means of distributing the opened fibres in a more uniform condition, previous to being lapped, than is effected by machines of the ordinary construction. The cotton, after passing from the beater, is taken up by the perforated cylinder, *a* (fig. 2.), the interior of which being partially exhausted of air by any of the usual methods, causes the fleece of wool to adhere with some force to the periphery. The cylinder and grating are covered

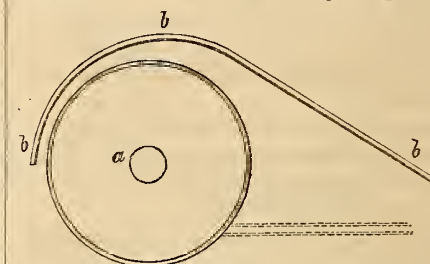


Fig. 2.

with a case, *b b*, forming part of that which encloses the beaters; the peculiar direction of which is said by the patentees to cause the fibres to be evenly distributed upon the surface of the cylinder, *a a*, and consequently upon the lap roller, by which it is finally taken up. The same patentees describe an improved arrangement of lap rollers, by which a large quantity of cotton is wound upon the lap roller. In the usual arrangement, the final roller is placed above the friction rollers; but in the one now under consideration it is placed horizontally before them. In fig. 3. we give a diagram illustrating the arrangement. The cotton is taken from the cylinder, *a a* (fig. 2), by rollers, in the usual manner, passed between a pair of calender rollers, and from these to the lap rollers, *a a*

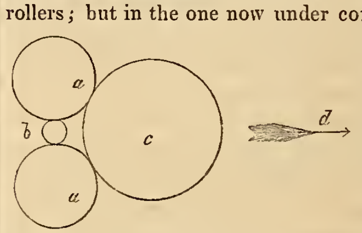


Fig. 3.

(fig. 3). The upper roller, *a′*, revolves in contact with and is supported by the intermediate and smaller roller, *b*; the cotton passes between the lower lap roller, *a*, and the intermediate, *b*. By this arrangement, the lap, as it is finally passed round the roller, *c*, is less distended than when it is placed above the rollers, *e e*, as in fig. 1. In the arrangement in fig. 1, as the lap, *f*, increases in diameter, it rises up, taking with it the link and weight, *g*, so that the pressure is always uniform. In the new arrangement, now treated of, the pressure is maintained, and the lap roller, *c*, always kept close up to the rollers, *a a′*, by the following mechanism. The roller, *c*, is supported on a traversing frame, which has its motion so that it moves out and in, approaching to and receding from the rollers, *a a*, in the direction of the arrow, *d*. Hanging weights are applied to the traversing frame in such a manner, that the roller, *c*, is always kept up to the rollers, *a′ a*, the frame giving way as the diameter of the lap roller, *c*, increases. The pressure of the roller, *c*, against *a′ a*, is regulated by the hanging weights. The roller, *c*, is caused to revolve solely by the friction of *a′ a*. The second improvement we have to notice is one patented by Messrs. Tatham and Cheetham, machine makers, Rochdale, and consists of the application of an additional pair of rollers, placed in the position as in fig. 4, at *b*; on the cotton passing from between the ordinary

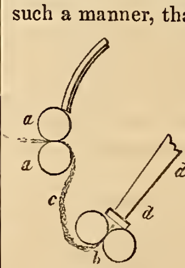


Fig. 4.

feed rollers, *a*, it is struck by the scutcher, *d*. This causes it to pass in the direction shown by the dotted lines; it is then taken up by the additional rollers, *b*, and once more subjected to the action of the scutcher. By this arrangement, the cotton is subjected twice to the action of the scutchers during one revolution. If desired, more than one pair of additional rollers may be added; thus, for certain qualities of material, acting still more advantageously. The cotton is greatly condensed upon the lap roller, by an arrangement in which the cotton is made to pass between a concave plate placed beneath the lap roller and the surface of the roller. The concavity of the plate corresponds to the convexity of the roller, and the cotton, in passing through, is drawn over the surface and condensed, before being wound upon the lap roller.

As will have been noticed, the action of the "blower," "beater," or scutcher, is calculated, while disentangling or opening the fibres of cotton one from another, to lay them at the same time in all manner of directions. Now, before cotton can be spun into thread or yarn, it is essentially requisite to have them all as parallel to one another as possible. This parallelisation is the important process which the machine next to be considered and known as the "carding engine," is designed to effect. The operation of carding may be defined to be a species of combing. If a number of fibres of cotton, in a state similar to that when passed from the "blower," be laid upon the teeth of a comb, some knotted and entangled, others lying in all imaginable directions one to another, and if another comb be brought in contact with these, and passed repeatedly from one end of the lower comb to the other, the fibres will be arranged parallel, or nearly so, to one another. The teeth of the comb, or carding surfaces, in the "carding engine," are made of wire, the form of which is shown in fig 5. The ends, *b b*, are turned at right angles to *a*, *c c* being placed at a determinate angle to *b b*. They are arranged in strips of leather, as *b b*, fig 6. Suppose two carding surfaces, as in fig. 6, be placed with the teeth in contact, but in opposite directions, if fibres of cotton are placed between these, and the combs moved to and fro, in the direction of their length, the cards, or teeth, of one comb will pull the fibres in one direction, while those of the other comb will endeavour to retain them; the consequence of this arrangement will be, that each comb, taking up a portion of fibre, will draw them out and dispose them parallel to one another, in the direction of the lengths of the combs. Again, suppose two combs to act on fibres of cotton placed between them, but the teeth of the cards to be placed not opposite to each other as above but in the same direction, it is evident that, if both moved in the same direction, but having different speeds, the comb moving fastest will strip off from the teeth of the slow-moving card all the fibres. This much being premised, we shall proceed to detail some of the minutiæ of the arrangement and construction of carding-engines. The strips of leather containing the card-teeth are arranged in parallel rows on the surface of a large central cylinder, as *a a* (fig 7). This cylinder, in some instances, is constructed of parallel segments of mahogany; but the improved method is by having on the periphery of the cylinder parallel strips of bay wood, the spaces between the strips being filled with cement, in which white lead is the principal ingredient. When this is hardened, the cylinder is put into a lathe, and the outer surface faced up true. Around the large cylinder, *a a* (fig 7), smaller ones are placed, having on their periphery spiral strips of card fillets. These small cylinders are sometimes termed "urchins," or "squirrels," but more frequently "strippers" and "clearers," as by them the cotton fibres are taken off the main cylinder and re-delivered. In some carding-engines, especially for cotton of low numbers, the carding is performed solely by means of the large cylinder and the smaller ones. In the section of the carding-engine an engine of this description is shown, the drawing there given being a longitudinal section, showing the arrangement of parts. This form is manufactured by Mr. Mason, of Rochdale, and is used chiefly for cotton to be spun into yarn of low counts, where rapidity of action is of importance. In some forms, however, flat top-cards, or "flats," as they are generally called, are used. The arrangement of these is somewhat as in fig. 8, where they are shown at *c c*, the card-teeth of the main cylinder sweeping over the surface of the flats at *c c*. As a general rule, the finer the cotton the more flats are used. In fig. 9 we give a diagram, illustrative of the arrangements of a carding-engine, in which the system of having rollers and strippers and "flats" are combined. The lap-roller is inserted in the slots; the cotton is then passed between the feed-roller, *a* and *a*, and caught up by the first card-cylinder, *b b*, termed the

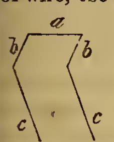


Fig. 5.

Fig. 6.

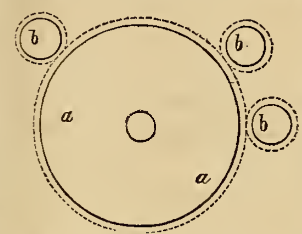


Fig. 7.

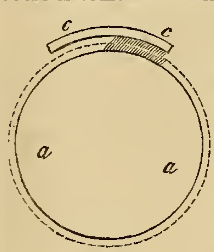


Fig. 8.

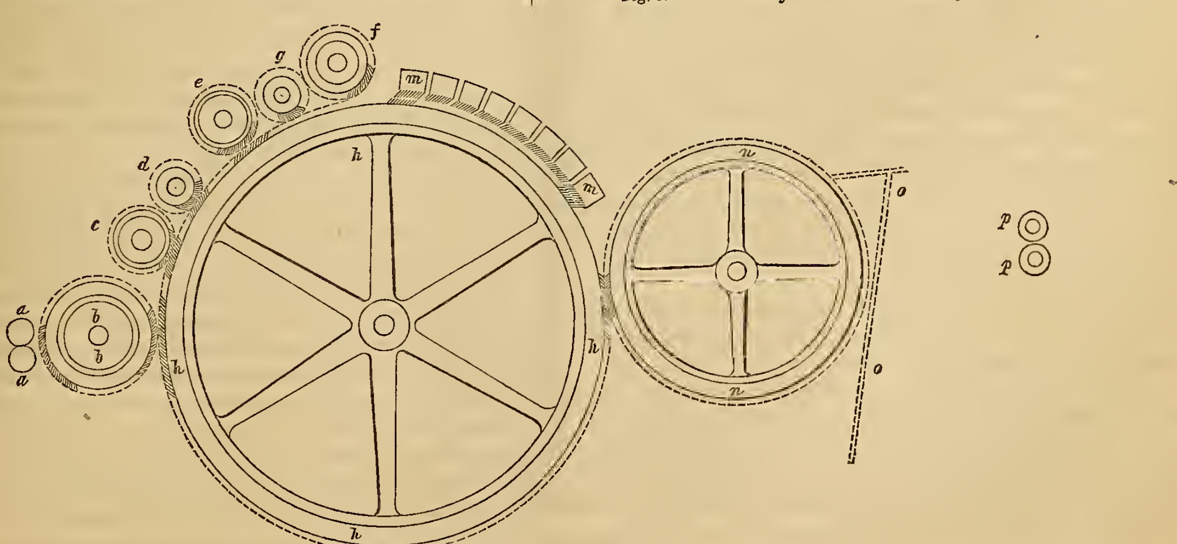


Fig. 9.

"licker-in." From this it is taken up by the main cylinder, *h h;* from this it is taken by the stripper or roller, *c;* from this it is taken by *d,* and delivered to the main cylinder; from this it is again taken by the stripper, *e,* which, in its turn, is stripped by *g* and *f;* and from *f,* taken up by the main cylinder. The "flats," *m m,* take the wool from the main cylinder, which, by its continuous rotation, re-takes it, and re-delivers it to the doffing cylinder, *n n;* from this it is stripped by the comb, *o o,* which receives its motion, as before described. The fleece thus obtained is contracted by passing through the trumpet-mouth, *p p,* and thereafter passed between rollers, and finally delivered to the can.

(To be continued).

BEET SUGAR MANUFACTURE,

WITH PLANS OF SUGAR WORKS, AS CONSTRUCTED BY M. DEWILDE, ENGINEER.

Translated for *The Artizan* from the French of M. Armengaud Aine.

Illustrated by Plates 11 and 12.

(Continued from page 126.)

TREATMENT OF THE BEET ROOT.

Washing the Roots.—As soon as the roots arrive at the works, they are placed in the washing machine, A, shown in plan in fig. 1, and in elevation in fig. 2, plate 12. This machine consists of a cylinder open at the ends, and formed of wooden staves, about 1 inch apart on the outside, and is mounted on an iron spindle, and slightly inclined. It revolves in a case, *a,* raised on a wooden framework, and filled with water. The roots are introduced at the upper end, through a hopper, *b,* and the cylinder being set in motion, are washed, and finally escape at the lower end, and fall on the inclined plane, B, which carries them directly to the rasping machines. Instead of inclining the cylinder, it may be made of a conical form, which produces the same effect. The water in the case is only changed when it becomes too muddy, and it is sufficient to take out the deposit and fill it up with fresh water.

This method of cleaning the roots, which is the most sure and speedy way, is insufficient when they are more or less deteriorated. In this case they are cleaned by hand, one by one, all the parts covered with earth being scraped with a knife, and the small roots, which harbour stones, cut off. This operation is performed by women; two of whom can prepare 4,000 to 4,500 roots per day. If the roots are large, they must be cut into two or more pieces to prepare them for the rasping machine. The loss from this operation is about 6 or 7 per cent.

As soon as the roots are cleaned, the juice may be extracted; and, to perform this operation, numerous plans have been tried, in order to obtain the best effect. In spite of scientific researches, and skilful endeavours, manufacturers appear to prefer the old-fashioned system, which consists in reducing the beet to a fine pulp, and expressing the juice by a powerful press, rather than those which proceed upon the principle of separating the juice, by slicing the root, and maceration, which is thus defined by M. Dumas:—"The operation consists in submitting the beet-root to the action of a bath, similar to that employed in the extraction of saltpetre, and in bursting the cells by briskly elevating the temperature by the admission of steam."

As, however, these last methods may prove very useful, when we have only desiccated beet-root to deal with, we will speak of those plans which have had the most notoriety.

Amongst the first, we have, by M. Mathieu, of Dombasle, a patent for fifteen years, dated 19th May, 1831, under the title of *Process for the extraction of Sugar from Beet-root.* The invention is based on the following facts:—1. If sliced beet-root be put to soak in cold or tepid water, the water will only absorb a very small quantity of saccharine matter, however finely the beet-root may be divided. 2. If the vital principle in the roots has been previously destroyed, either by their desiccation or by the application of a sufficient degree of heat, the affinity between the liquid and the saccharine matter in the roots acts without obstacle, so that it effects a division of the saccharine matter between the liquor in the roots and that in which they are soaked. This division takes place in less time, as the roots are more finely divided, and, to some extent, at low temperatures.

On this principle, if we cut the beet-roots into slices about one-quarter of an inch in thickness, and, adding water, boil them by steam or other means for half an hour, the water will extract about half the sugar contained in the roots. When this water is drawn off, if a similar quantity of fresh water be poured over the roots, it, in its turn, will extract the half of the sugar remaining in the roots, and so on, until, by repeated maceration, the whole of the sugar is extracted. On the other hand, if we take a fresh quantity of roots, and macerate them in the liquor first obtained from the previous mass of roots, this liquor, already charged with saccharine matter, will take up an additional quantity; and by repeating this operation with fresh roots any required number of times, it will acquire a density equal to that of the juice which the same roots would have given by expression. This juice may then be treated in the ordinary way, with lime, animal charcoal, &c. This method of maceration has only been practised with success in combination with hot water, whether by means of single vats, by the continuous system of filtration of M. de Beaujeu, or by the Champonnois macerator. This last apparatus, as well as the rest, has the inconvenience of requiring heat. It is, in fact, demonstrated that the heat transforms the crystallisable sugar into uncrystallisable, or molasses; and so far, the experience of the laboratory is always confirmed by practice. It is principally during the maceration that this destructive effect takes place, when the beet-juice is not yet separated from foreign matters. To obviate these inconveniences, the better informed amongst the manufacturers have employed the cold system of maceration, but hitherto without success. Mr. Huart took out a patent in 1833 for a process of simple filtration of cold water through the pulp, and this would have been very valuable, had the filtration been practicable on a large scale; but experience proved the contrary. M. Beaudrimont attempted to force cold water through the pulp, in an apparatus like the filter-press of M. Réal, but did not succeed. M. Legavrian, instead of forcing the water from above, tried the upward system of filtration, but with no better result. The cold water refuses to pass through the mass of pulp, and the inventor is obliged first to extract a part of the juice by pressure, in order to be able to apply his system to the pressed pulp, to set free the sugar which escaped the press. M. Ducel, of Paris, has pursued an inverse process, by first macerating the pulp in cold water, and then pressing it, to extract the juice, which is thus diluted with too much water. All these processes have been abandoned, and have only served to show that the products of the cold system surpass those of the hot, both in quantity and quality.

Messrs. Martin and Champonnois having recognised, by numerous trials, the impossibility of passing cold water through the pulp, when in a state of repose, have tried a method of agitating the pulp in cold water. Their apparatus (patented 30th June, 1835) consists of a large vertical cylinder of wood or metal, having a double bottom of metal, pierced with small holes, and forming a strainer. In the centre of the cylinder is a revolving shaft, furnished with inclined arms or agitators; and the pulp, roughly rasped, being put into the cylinder by a syphon leg below, is carried up to the top by the movement of the agitators, and discharged on to an inclined plane. In its passage upwards through the cylinder it meets a descending stream of cold water, with which it is ultimately mixed, and which, after extracting the sugar, escapes by an opening provided for it in the false bottom.

The Pelletan *levigator,* patented the 5th August, 1836, is still em-

ployed in many faetories. It is composed of an Archimedean screw, of which the thread is of copper, working in a case of sbeet-eopper. This serew is placed obliquely, the angle being varied at pleasure, and turns, in bearings, at the rate of one revolution per second. At tbree-fourths of its beight is placed a eurved tube, tbrougb whieh the water is introduced. Tbe pulp is fed in at tbe bottom by a child, and raised by the screw, meeting the descending current of water, wbieh, mixing witb it, carries off the sugar, and escapes into a vessel beneath.

This machine, says M. Dumas, ean work up 15,000 kilog. (33,075 lbs.) of beet-roots per day. It presents an economy of labour, and perhaps a slightly increased yield over presses; but these advantages are eounterbalaneed by the eost of fuel and the waste of the pulp, whieh is almost entirely lost.

M. Payen, in his *Précis de Chimie industrielle,* thus speaks of two new proeesses for the extraetion of the juice; the one by M. Claës, and the other by M. Tilloy, of Lille :—

"M. Claës has succeeded in extraeting a large proportion of the juice by eombining the old method of presses with M. Boueher's levigating process. This mixed process eonsists in washing the pulp, and then using the exeess of water whieh it retains to exhaust another portion of pulp already treated by the press. Ten rows of vessels eontaining the pulp are arranged in endless ehains, set in motion by pullies. The vessels, the bottoms of whieh are eomposed of wire-eloth, are disposed in sucb a way, that the liquid filtered through one row falls into the vessels of a lower row. Water is poured into the first row only, so that, in its passage from the first to the tenth, it beeomes almost as rich as the juiee itself. The pulp in the upper range of vessels, drained of the water, re-descends upon the endless chain, balancing the weight of the ascending vessels, and arrives at the bottom. It is then mixed with pulp from hydraulie presses, and furnishes it with water, whieh, by the endosmose and exosmose aetion, causes the eellules to give up their juice, and the two pulps, when pressed in hydraulic presses, give a fresh quantity of juiee. The mixture of the two pulps serves to feed eattle, whilst the pulp from tbe ordinary levigators contains too much water for that purpose."

"M. Tilloy employs another method of levigation. As soon as tbe pulp leaves the press, the bags are plunged for an instant into water, eontaining $\frac{1}{1000}$ part of tannin. A seeond pressure gives one-half the juice wbich the pulp retained, and the bags are then again plunged into the same water, which they absorb, and are pressed a third time. The aqueous juice whieh comes from them serves instead of water to steep the bags after the first pressure. They obtain thus, at the first pressure 70 per cent; at the second 16, and at the third 9, making a total of 95 per cent."

The Rasping Process. We have already said that, after being washed, the roots are carried to the rasping machines, whieh effect the tearing asunder the cellular tissue eontaining the juiee. The rasping maebine is sbown at C, figs. 1 and 2, plate 12. We may have oecasion hereafter to give details of this machinery. Tbe objeet is to divide the particles as finely as possible.

The Squeezing Process. As soon as the roots have been reduecd to a state of pulp by the rasping machine, it is eollected by a workman with a shovel, and thrown into a linen bag held ready by another workman, and as soon as filled, it is submitted to the action of a press. Tbese bags are ordinarily about 14 inches wide by 20 to 25 long, but their size is only limited by the table of the press employed.

Tbe linen is very strong, and should not be too close in its texture, in order to allow the juice to eseape freely.

Woollen bags are also used, which are said to be cheaper, and more durable.

The quantity of pulp put into them should be such, tbat when squeezed out it will not exceed 2 inches in thickness.

The manufacturers here differ in their mode of treatment; some have used a kind of rolling mill, whieh they have been compelled to give up, from the small quantity of juice yielded, only 50 per eent. Tbe greater number have employed bydraulie presses, whieh naturally suggest themselves as the most eonvenient. For a time, the "Peequeur" presses were mueh talked about, but they bave, nevertbeless, been given up. The hydraulic presses have prevailed, and were, until lately, exelusively employed. Tbey, however, use now, in many factories, an additional preparatory press, bearing the name of the revolving juiee table (*table pivotante à jus*).

This apparatus is shown by D in the general plan, fig. 1, plate 12, and in detail in figs. 7 and 8, in plate 11. It is eomposed of a east iron table with three wings, furnished witb grooves, *a* to faeilitate the eseape of the juiee. The table is supported by a east iron base, bolted to the foundation, and carries in the eentre a wrought iron spindle *e*. On this spindle slides a frame *f*, whieh ean be adjusted at any height above the table, and whieh earries a hand-wheel *g*, and pinion, whieh takes into a second wheel, and through anotber pinion gives motion to the raek *i*, and the press *j*. The raek is held in a vertieal position by two rollers at the baek, as is usual. The juiee eseapes by the spout *k*; the bag of pulp, streaming with juiee, is laid as soon as filled, on a wicker hurdle; another hurdle is superposed, and then another bag, and so on, until a sufficient number of bags is aeeumulated. (The wieker hurdle absorbs some of the juiee and requires frequent repairs; sheet iron has been used with good results, it is said.) The pile of bags, having been laid upon one of the wings of the table, the press is brought down on it by the workman turning the hand-wheel, and wbilst this operation is being performed, another pile is placed on another wing. As soon as the press is raised, the table is turned one-third round, and the fresh pile of bags brought under the press, whilst those already pressed are removed. The juiee expressed runs into the general reservoir H, plate 12.

M. Trésel, maehine maker, of St. Quentin, has improved tbis apparatus by making four wings to the table, and making the press deseend by a vertieal screw moved by a horizontal fly-wheel. His machines are strong and well-designed.

When the bags of pulp have received tbis first pressing, they earry them to the hydraulic presses, E. Six of these presses are arranged in a semieirele round the revolving juiee table, for the faeility of moving the bags, and the juice runs by the gutter, *j* (fig. 1), to the vat, H. The injection pumps for the presses are shown at F (figs. 1 and 3), and are driven by a shaft, *k* (fig. 3). On this sbaft are three pulleys; *l*, which drives the rasping machine, C; *m*, whieh drives the wasbing maehine, A; and *n*, whieh drives the injection pumps, F.

M. Dorey suggested, in 1837, a system of presses combining the advantages of the press and of the maeerating process, without entailing their inconveniences. His system is based upon the property whieh two liquids of different densities possess of remaining in two strata, unmixed, even when exposed to eonsiderable pressure. The water, by its inferior speeifie gravity, remains above the beet juiee, and entering between all the particles of the pulp, extraets the juice, so as to produee as mueh as 90 to 92 per eent. of the juice perfectly pure.

On this plan, the water cannot be mixed with the juiee, exeept when the operation is stopped, wben, in order to empty the eylinders of pulp, a little water cannot fail to eseape; but, as the operation is continuous, this inconvenience is only felt when the work is suspended.

The proeess is very simple and effieaeious. To commence operations, the rasped pulp is put into a cylindrical vessel, with a metal sieve at bottom, whieh stands on gutters. Then, by means of a wheel and pinion, this vessel is brought under one or other of two large cylinders, which form the principal part of the apparatus, and the

sieve (with the pulp) is elevated by means of a screw passing through the bottom of a reservoir, at the base of the apparatus, until it is held in position by four spring catches, which prevent it descending. The screw is then lowered, to admit of another sieveful being added, and so on, care being taken to open the cylinder at top, in order to allow the air to escape.

When the cylinders are filled with pulp, they proceed to fill them up with water, taking care first to place on the top a wire netting (with a hole in the centre), to prevent the too great disturbance, which would favour the mixing of the two liquids. This operation finished, the cover of the cylinder is fastened down by means of a screw. This done, they continue to introduce additional masses of pulp from below, and the water, having no escape above, is compelled to descend through the pulp, carrying the juice before it, which falls into the receiver provided for it. When the sieves have arrived at the end of the cylinder, it is necessary to take them out, to add fresh ones, and, for this purpose, the cover is taken off. The pulp is compressed into half its original volume, and having been squeezed into a recess left in the cover, can be readily taken out without being spilt. It is totally devoid of juice and flavour, and is finally dried by pressure in an ordinary screw press.

Before replacing the cover, it is necessary to add a quantity of water, to replace that taken off in the pulp, in order to keep the water in the cylinder at the same level. This quantity is easily calculated; it is only necessary to know the weight of the pulp when it enters the cylinder, and when it is taken out, and to deduct from the latter 3 per cent., calculated on the original weight, the weight of the solid matter remaining the same. Thus, say,

Pulp put on the sieve	50	kilog.
Pulp taken out	25	„
Difference	25	„
Deduct 3 per cent on 50 kilog. for solid matter	1·50	„
Weight of liquid taken with the exhausted pulp	23·50	„

This, then, will give 23½ kilog. of water, which must be introduced into the cylinder at each time, to keep the water at the same height. The water put in, and the cover replaced, a fresh sieve full of pulp can be introduced, and so on, until it is desirable to cease work. To exhaust the pulp remaining in the cylinder, empty sieves can be put in, until all the charges are exhausted.

This mode of extraction, which appears very rational, has not been persevered in, from the difficulties attending the evaporation, and the expense. The same idea has been tried in 1831, by MM. Graar. Their plan was to put a certain quantity of pulp into a cast iron cylinder, with a perforated bottom, over which was placed a fine cloth. Water was poured on, which filtered through and extracted the juice; but all these plans (says M. Caillat) lead to the conclusion, that one liquid cannot completely displace another without their mixing, and that there is a limit to the action of this apparatus, which is determined by the too rapid escape of the juice, under a certain pressure, which will not permit another fluid to replace it.

M. Hamois was the first who proposed to press the bags of pulp twice over. In addition to this, M. Demesmay proposed to submit the bags of pulp to steam, in a close chest, but in a few minutes the pulp was reduced to a jelly, and the juice could not be extracted. By this process they obtained 75 to 85 per cent. of juice.

MM. Hallette and Evrard, patented, 21st July, 1845, a process, in which the pulp, after being squeezed in a hydraulic press, was to be submitted, in bags of an impermeable material, to steam and pressure; but we are not aware what success they obtained.

MM. Pruvost, Coudroy and Co., have patented, 13th November, 1847, steam presses, in which the pressure of steam on a piston is made to supersede the manual labour otherwise employed.

Treatment of the Juice.

The juice of the beet root, in the state in which it leaves the presses, is slightly milky, inclining to a yellowish white, and sometimes to a greenish tinge, when the roots are not quite ripe; and, at other times, to a reddish white, after the colour of the roots used. When it is exposed to the air, the colour changes to a light violet, and then this tint becomes deeper, and finally changes to a dirty brown. If it be left for some hours in open vessels, it finally acquires a ropy consistency, and begins rapidly to decompose at a temperature above 15 or 18 centi. M. Decock has lately proposed, to remedy this inconvenience, to add tannin in powder, which is efficacious in preventing fermentation, and which has but trivial inconveniences attending it.

The Defecating Process.—This is the first chemical operation which follows the extraction of the juice, and is for the purpose of depriving the juice of the soluble and insoluble foreign matters present, and which would otherwise deteriorate the sugar. The juice is taken from the vat, H, to the defecating pans, I, by means of a "liquor lift" (*monte-jus*), worked by steam pressure. This liquor-lift, *p*, is a vessel of wrought or cast iron, communicating by an orifice at the bottom with the juice-vat, and connected at the side by a pipe to the steam boilers, K. When it is desired to elevate the juice, the lift is filled with steam by opening a cock, and this steam being condensed, forms a vacuum, which fills the lift with juice by the atmospheric pressure. On the steam being again admitted, it forces the liquor up the pipe, *o*, which is provided with cocks, to fill either of the pans, I. Although not so stated by the author, it appears that a valve is required between the vat and the lift, which would allow the lift to fill, but not allow the juice to flow back. The pipe, *o*, is of course carried nearly to the bottom of the vessel forming the lift, so as to keep it full of liquor.

Fig. 9, plate 11, represents a section of one of the defecating pans complete. The upper cylindrical portion is of copper, with a flange at the bottom, to which is attached a nearly hemispherical bottom, *a*, also of copper. This has a cast iron cover, *b*, which leaves a vacant space between for the admission of steam to heat the liquor. The liquor is drawn off by the cock, *c*, which is constructed in a peculiar manner. The shell of the cock has three openings, one above the other, and the plug has also three corresponding openings, but arranged round the periphery in such a way that only one can open at a time. The top of the plug is of course closed, and the bottom, where the handle is fixed, open. By turning the plug round, therefore, so as to bring either of the openings together, the defecated liquor can be drawn off at three different heights, as the defecation takes place.

Another cock is provided, to admit the steam to the double bottom, and is also made to carry off the condensed water, which returns into the boiler. It is desirable that these two operations should be performed simultaneously, or the unrelieved pressure of the steam might distort the thin copper bottom of the pan, or disturb the defecation, and the following arrangement is adopted for the purpose. The plug, *d*, has two passages, the upper in connection with the steam pipe and the passage, *e*, and the lower in connection with the escape pipe and passage, *g*. In this way, one passage cannot be opened without the other.

M. Nillus, of Havre, proposed, in 1845, a different construction for the defecating pans, shown in fig. 10. In this plan, the copper bottom, *a*, is made concave instead of convex, so as to withstand the internal pressure, and is further strengthened by the stay, *b*. The cocks are of the ordinary construction, *c* being to draw off the defecated liquor, *d* to admit the steam, and *e* to allow the condensed water to escape.

It is by the aid of lime that the chemical result of the defecation

is obtained. An excess of lime, says M. Payen, renders the evaporation difficult; the portion of saccharate of lime not decomposed by the charcoal or the carbonic acid of the atmosphere cannot crystallise, augments the quantity of molasses, and renders the sugar viscous. The quantity of lime necessary varies according to the quality of the beet roots, and the time of using them. At the early part of the season, they employ about 3 kilog. of lime to about 1000 litres of juice; but when it is advanced, this quantity is increased to 6, 8, and even 10 kilog. to the 1000, the growth of the beet having increased the quantity of free acids.

Before proceeding with the defecation, it is necessary to kill the lime completely, by mixing with it about ten times its weight of hot, or even boiling water. It is then passed through an iron wire-sieve, to separate the sand and other foreign matters. This important operation can be best performed, when operating on large quantities; as, for example, on 150 to 200 kilog. of lime, representing about 50 defecations, of 1000 litres of juice each. The management of the dose becomes more easy, for, at each defecation, it is sufficient to take the specific gravity of the milk of lime, taking care to agitate it, to render the density uniform, before plunging in the instrument. If the milk of lime marks 10°, about 30 litres are necessary to represent 3 kilogrammes of dry lime.

We have already said, that it is necessary to raise the temperature briskly to 75°, when the lime is to be added, the liquor being agitated, to mix it thoroughly. The temperature is allowed to rise, and as soon as any sign of boiling appears, it is checked by shutting off the steam, and admitting air into the double bottom of the pan, as, if the boiling were continued, the liquor would remain turbid.

The defecation is judged to be perfect when the liquor is clear, the flakes well separated, the scum solid and of a greenish brown colour; when it detaches itself from the sides of the pan, and cracks at the moment of boiling, and when an ammoniacal odour prevails then in the steam. When the defecation does not present these symptoms, and, above all, when the limpidity of the liquor is imperfect, the proportion of lime must be changed. The proper dose is arrived at, after some trials, but to obtain complete clarification it is impossible to avoid erring on the side of excess of lime, which unites with the sugar, and to remove which afterwards has attracted the attention of the manufacturer for a long time.

Sulphuric acid has also been employed for the defecation. Achard first pointed out this method, which was for a long time in use, but is now entirely given up. MM. Crespel have used a modification of this system, by employing less acid, only 150 grammes per hectolitre, and then saturating it with quick lime. M. Bouché has used alum, and obtained good results. Nevertheless, by this process, there is a risk of leaving the sulphate of potass in the sugar. On the perfection of the defecation depends the quality of the sugar, and the more care is taken in this step, the less the trouble in purifying the sugar, and the less the quantity of molasses. After the defecation, the juice has less specific gravity, by reason of the precipitated matters. Thus, the juice from the presses will indicate 6° or 8° on the hydrometer, and after defecation, only 4° to 6°.

The liquor runs from the defecating pans by a pipe, *v* (fig. 4), into a gutter running along the top of the filters, O. The scum is received by a truck, M, running on a railway, and is afterwards put in bags and pressed under presses N. These presses are entirely of wood, and offer no subject for remark.

The first filtration. The defecated juice is submitted successively and alternately, a various number of times, to concentration and filtration; the order and the number of the operations depending, in a great measure, on the system pursued by the manufacturer. The method most followed, and that which we shall describe, is to filter after the defecation, and then to concentrate to 25° or 27°; to refilter, and to boil.

As soon as the defecation is finished, the clear liquor passes into the filters, O, which are filled with granulated animal charcoal, which has already served for the final filtration of the syrups. The filters usually employed are cylindrical vessels of cast-iron, containing from 3,000 to 4,000 kilog. of charcoal, and furnished with a manhole above the double bottom. In order that the filtration should be regular, and to prevent channels forming through the charcoal, its surface is kept constantly covered with liquor, which is supplied by ordinary ballcocks, seen in plan, fig. 1, pl. 12. The double bottom has a communication with the atmosphere by a tube inserted in it, which allows the air to find its way between the particles of charcoal, and to escape as fast as the syrup descends. The filtered liquor is run into a vat, or at once put into the evaporating pans. It is led by the gutter, *z* (fig. 2), and the pipe, *y*, into the reservoir, P.

The first evaporation, which is only a preparatory operation, is designed to precipitate the soluble salts, which had escaped the first filtration. Achard, whom M. Dumas calls the "Father of the beet-sugar manufacture," had, from the first, appreciated the difficulties which the use of a naked fire presents, and had tried heating by steam; but he committed the error of using steam of low pressure, which would only raise the temperature of the juice to 70°, which rendered the evaporation very slow, and rendered a large portion of the juice uncrystallisable. These unsatisfactory results led them to use the naked fire, its inconveniences being compensated by the rapidity of the process, and the quantity of the produce.

The use of high-pressure steam and suitable apparatus unites the advantages of an equal temperature, a facility of adjusting it instantaneously, and a rapidity of evaporation superior to that of an open fire, since, by the use of steam, the heating surface can be increased without risk.

There exist two systems of evaporation, in one, the air being removed (the vacuum pan), and, in the other, not. The former is used in large works and refineries; the latter is the more common. Various apparatuses are in use. Those by M. Dubrunfant, and those of M. Péan, composed of an inclined plane, cut in steps, and receiving the syrup at the upper part. Others, by the same maker, had a plate, furnished with transverse divisions, with openings alternately to the right and left, so as to make the syrup take a long course; these apparatuses were heated by steam. There is also the plan of M. Brame-Chevalier, of forcing hot air into the liquor, the expense of which was not compensated for by the advantage gained; and that of M. Pecqueur, composed of a pan heated by numerous tubes, about 2 inches in diameter, separated one from the other, and running into a general pipe going round the pan, and opening into a second pipe. The pan swung upon two trunnions, one serving for the admission, and the other for the escape, of the steam. This arrangement gave great facility for emptying the pan of syrup, by swinging it over. Many other attempts continue to be made, but none of them have perfectly succeeded.

The apparatus most commonly used is that represented as Q in the general plan, and in detail in figs. 5 and 6, plate 11. It is a copper pan of a cylindrical form, and furnished with a coil of steam pipe, *a a*, arranged so as to distribute the heat equally, the coldest portion of the pipe lying next to the hottest. The coils of pipe are held together by four stays, bolted through from side to side. The pan is provided with a cover, in two parts; the hinder half fixed to the pan, and carrying the chimney, *b*, while the other half is hinged on to it, and is furnished with a circular plate of glass, seen in plan, fig. 1, through which the process which the liquor is undergoing may be observed. As it is found that the vapour condensed in the chimney is apt to return in drops into the

pan, the chimney is provided with a short internal pipe, *c*, which forms a channel to receive the condensed water, which is led off by the drain-pipe, *d*. The defecated and filtered liquor is brought to the pans by a pipe, *e*, connected to each by cocks.

The emptying of the pans is effected by a large cock, *g*, placed at the bottom of the pan, and conducting the liquor again to the charcoal filters, through the agency of the second liquor-lift, p^2. Thus the horizontal gutter, *l*, and the tube, *m*, carry the liquor to the vat, R.

Of the second filtration. The complementary operation of filtration is intended to extract, by means of the animal charcoal, those foreign substances which had escaped the first filtration, to retain the lime precipitated by the evaporation, and to deprive the syrup of the colour which the evaporation gives it. The second filtration is effected with the same sort of filters, and with the same precautions as the first, but care is taken to use fresh charcoal, which, after being thus used, serves for the first filtration. The syrup then comes from the filters clear and limpid, and is fit to undergo the operation of boiling, and to give crystals of a good colour. It flows through the pipe, n^2, into the reservoir, S, whence it is raised into the vacuum pan by the air-pump attached to it.

The boiling in vacuo. The vacuum pan is usually placed on the same floor as the filters and evaporating pans; T, fig. 1, plate 12, is the vacuum pan, U the condenser, and V the air-pump, which do not differ from those usually employed. When the syrup is sufficiently boiled, it is run, by means of the gutter, *x*, into the large receivers, X X, where crystallisation commences.

(To be continued.)

AGRICULTURAL ENGINEERING.

REPORT ON THE APPLICATION OF LIQUID MANURE BY STEAM POWER AT EDINBURGH.

BY W. LEE, ESQ., C.E.

It will be understood that, in speaking of superficial area, the Scotch acre is always intended. It contains 6·084 square yards, equal to 1·271 acres English, or rather more than an acre and a quarter.

The old Craigentinny meadows, irrigated by the Foul burn, have been in existence probably sixty years, and contain about 180 acres. They are not laid out so methodically as the more recent part of the work. Mr. Buchanan has a plan of the whole, showing the open gutters and panes, on a scale of four chains in an inch. The more recent portions are the sea-meadows and the high level, which is irrigated by means of a steam-engine.

The soil of the old meadows is a hard clay. Some of it had been underdrained before the irrigation began; but the drains were found to carry off the irrigation-water, and were also in the way of the levelling operations, and were therefore destroyed.

The sea-meadows were formed in 1826, upon what was a mere series of sand-hills and beach, without any soil at all. What little soil there is now has resulted from the application of the sewage-water.

About fifty acres are above the level of the "burn." For them the sewage-water is lifted fifteen feet by a steam-engine of eight horse-power, at Southside farm.

Having ascertained that the irrigation goes on upon the high level for the same length of time, and is repeated, after the same intervals, as in the portions where no artificial power is used, the steam-pumps become standard measures by which to ascertain the quantity of town sewage-water capable of producing such great fertility.

The engine is capable of irrigating a very much larger surface; but it is used also for threshing and other farm purposes. The cylinder is 10 inches, working from 30 to 40 lbs. pressure, and making 46 strokes per minute. There are two pumps with 18-inch barrels, making 14 strokes per minute, and having alternate action of 2 feet 9 inches, or 3 feet 6 inches. I find the quantity raised to be 93½ cubic feet per minute. The engine works night and day; but the time occupied for irrigation amounts to about 224 days, of 12 hours each. Two tons of fuel are consumed per 24 hours, at 5*s.* 3*d.* per ton; and there are two enginemen and two watermen, who attend to the gutters, I ascertained that the ordinary working expenses of the engine, including wear and tear, amounts to 10*s.* 6*d.* per 12 hours.

The result, when reduced to a practical shape, is strongly against the economy of surface-irrigation by open gutters and surface-shedding, when compared with the effects produced by pipes and jet, hereafter to be considered. In this case, the quantity of fluid applied is so enormous, that a very large portion of it must escape into the sea, without being productive of any good. The amount calculated from the pumping power is equal to 66 inches in depth over the whole surface, during the course of the year, or 8,886 tons per acre, taking the specific gravity of the sewage at 66 lbs. per cube foot. During the present season, the whole of the meadows have been watered, according to the statement of Mr. Bryce, eight or nine times, so that each application was equal to 1,000 tons per acre. It must be remembered, that these quantities refer both to the irrigation by steam-power and by gravitation.

The total area irrigated by the "Foul burn" is about 260 acres; and I find the average discharge of sewage-water from that part of the city draining into it to be about 220 cubic feet per minute. Exclusive of Sundays, this would give a quantity equal to 11,232 tons per acre per annum; but, taking the number of days during which the process of irrigation goes on at 224, as in the former calculation, the net quantity laid on will be 8,042 tons per acre per annum.

When it is considered that some of the fluid is used more than once, and that storm-water requires some margin, these two statements of quantity corroborate each other in a remarkable manner.

The laying out, levelling, gutters, and sluices, in the old meadows would, in the opinion of Mr. Buchanan, cost nearly £15 per acre; but it was done piecemeal, and in a very irregular manner.

The 30 acres of sea-meadow cost £700 laying out, equal to £23 6*s.* 8*d.* per acre. The ground was very rough—absolutely worthless—and the work expensive.

The remaining part, including the high level, varied from £30 per acre to £6, but the average was about £15 per acre.

With respect to the high level, the steam-engine was already upon the farm, but its value, and also that of the pumps, must be taken into account. A deep open gutter, of about 250 yards long, and a tunnel of about the same length, had to be driven, to convey the sewage to the engine-well. These two cost upwards of £1000.

The working expenses, for the irrigation by gravitation, may be taken at 13*s.* 3*d.* per acre per annum, including the cleansing of the open gutters. The following, therefore, appears to be the cost of the open-gutter system:—

HIGH LEVEL.

Forming 50 acres, at £15	£750	0	0
Engines and pumps, say	250	0	0
Tunnels and gutter	1000	0	0
	£2000	0	0
Annual interest and depreciation, 7½ per cent..	£150	0	0
Wages, fuel, &c., 224 days, at 10*s.* 6*d.* ..	117	12	0
	£267	12	0

Equal to rather more than £5 7*s.* per acre per annum.

Sea Meadows.

Annual interest, &c., per acre	£1 15 0	
Annual working expenses	0 13 3	
Per acre	£2 8 3	

Old Meadows, &c.

Annual interest, &c., per acre	£1 2 6	
Annual working expenses	13 3	
Per acre	£1 15 9	

The total capital invested is about £5,400, and the annual working expenses, exclusive of interest, £256 14*s.* 6*d.*

Before making a few remarks on the value and produce of these meadows, I must observe, that their great fertility is extrinsic, and entirely independent of the nature of the soil. There is no principle of vitality in the mineral particles of clay and sand, but when the elements of vegetable substances are largely applied, in a state of solution, to the germs and roots of plants, an unprecedented state of fertility is produced, equally upon lands of the most opposite character. Some of these meadows are heavy, undrained clay, which, in a state of nature, would be almost sterile; and others are porous sea-sand, absolutely worthless only a quarter of a century ago, yet both, at the present moment, are yielding upwards of ten times the average value of agricultural land in this country. These remarks, as to the character of the soil, are of course applicable to all the places visited, and, in fact, to soils generally.

During a careful examination of these meadows, I could not observe any difference between those nearest to the city and those adjoining the sea; but it appeared that generally the oldest meadows were the most fertile. On inquiry, I was informed by Mr. Bryce, that the action of the sewage-water is not a sudden impetus, followed by reaction and exhaustion, but the land goes on increasing in value, according to the length of time the system has been in operation.

I observed no stench at all on the meadows or the carriers; I could distinguish it, however, where the tailwater of the burn, after passing through a sluice, tumbles down a roughly-paved incline. The weather was cool at the time.

The fifth crop of grass since April was being cut off these meadows at the time of my visit in October.

A very fine crop of turnips, expected to realise about £25 per acre, had been manured by a dressing of the liquid before sowing, with the addition of about 24 loads of the cleansings of the gutters, and 16 loads of farm-yard litter, per acre.

Mr. Bryce, the manager, said, "I would prefer for turnips even the cleansings from the gutters, with farm-yard manure to guano with farm-yard manure, because the sewage refuse has more durability than guano. I shall have a good crop of barley after these turnips without further solid manure; and then sow down for grass; I could not do that with guano."

A very small plot of this land is let at present at £9 per acre, but, in general terms, the inferior meadow produces £11. The highest rent this year is £31. There are several lots let at £30 per acre, and the average of the whole is more than £20.

I have only to mention one additional fact respecting the value of these meadows:—The Leith branch of the Edinburgh and Dalkeith Railway passes through the meadows formed about 25 years since out of worthless sea-beach. The value of the land had to be settled by a jury, who, after hearing all the evidence on both sides, awarded 33 year's purchase at £20 per acre, making £660 per acre as the value.

NOTES BY A PRACTICAL CHEMIST.

Preparation of Benzoic Acid by Sublimation.—Benzoic acid, as ordinarily obtained by sublimation, is apt, in course of time, to grow yellow, from the presence of an essential oil. This may be avoided by operating as follows:—The gum benzoin, in coarse powder, is spread at the bottom of an iron vessel, then covered with a layer of animal charcoal of half a centimètre in thickness. The vessel is then tightly covered over with a sheet of porous paper, as in Mohr's process, whilst above is placed a stout paper cap which exactly fits the sides of the vessel. The whole is then exposed to a moderate heat in the sand bath.

Preparation of Pure Potassa.—The usual process is to ignite the bitartrate, wash the residue with pure water and boil the solution of carbonate of potassa thus formed with hydrate of lime in an iron vessel. The solution of hydrate of potassa is then boiled to dryness, the residue dissolved in alcohol and evaporated in silver dishes. The potassa thus prepared is usually free from sulphates and chlorides, but contains very frequently a trace of the silicate of potassa. This impurity, according to Mr. H. Wurtz, may be thus removed. An aqueous solution of the carbonate in question is evaporated to dryness in sheet-iron vessels at a sand heat, lumps of carbonate of ammonia being added from time to time. The silicate of potassa is thus converted into carbonate, and on redissolving in water, the silicate appears in the form of flakes floating on the liquid, and may be separated by filtration. The filtered liquid, free from silica, may now be used for the preparation of pure hydrate of potassa, taking care to use lime which is likewise free from silica.

A solution of hydrate of potassa kept in glass bottles becomes, in course of time, impure, by taking up silica from the glass. Flint glass bottles will preserve such a solution much longer than any other. Pure silver is, however, the best material for bottles in which solution of potassa is to be preserved.

ANSWERS TO CORRESPONDENTS.

"P. T." We can by no means share in your approval of the cultivation of beet-root for the purpose of manufacturing sugar. For an able exposure of its fundamental fallacies we may refer you to Liebig's "*Letters on Chemistry.*" Beet-root sugar is only able to maintain itself by the aid of accidental advantages. Give the tropical agriculturist the benefit of due mechanical and chemical appliances, and place him on an equal footing as regards import duties, and the cane will at once drive its puny European rival out of the market. The cultivation of beet-root in England or Ireland is especially to be deprecated, because as soon as they find themselves unable to cope with their opponents, those engaged in it will begin to clamour for protective duties.

"Zero." Opium *can* be made to yield colours very similar to those obtained from madder, but its high price renders them of little importance in a practical point of view.

"A Student." The boundary line between metallic and non-metallic bodies is now very hard to trace, many substances, such as iodine, silicon, arsenic, selenium, and tellurium, being alternately assigned to the one and the other of these great classes; whilst concerning even those whose place is uncontested very few general truths of value can be asserted. S.

PITCHER'S PATENT HYDRAULIC STEAM ENGINE GOVERNOR.

We consider ourselves fortunate in having lately introduced into this country several worthy specimens of American ingenuity, and the numerous inquiries which they have occasioned us is the best proof that our labours have been appreciated amongst our daily increasing

circle of readers. On the present occasion, we have to direct attention to a subject of the highest importance to our great "cotton interest"—the more perfect regulation of the prime mover of their mills, a point on which much ingenuity has been expended, with a very disproportionate result. The principle of this invention, which we owe to Mr. L. B. Pitcher, of Syracuse, U. S., is briefly this—a small pump, set in motion by the engine, keeps floating, by the water it delivers, a plunger working in a cylinder. The water has a certain area to escape through, and if the speed of the engine (and of the pump) increases, the water being delivered faster than it can escape, causes the plunger to rise, and by its connection with the throttle valve, shut off the steam, and *vice versâ.*

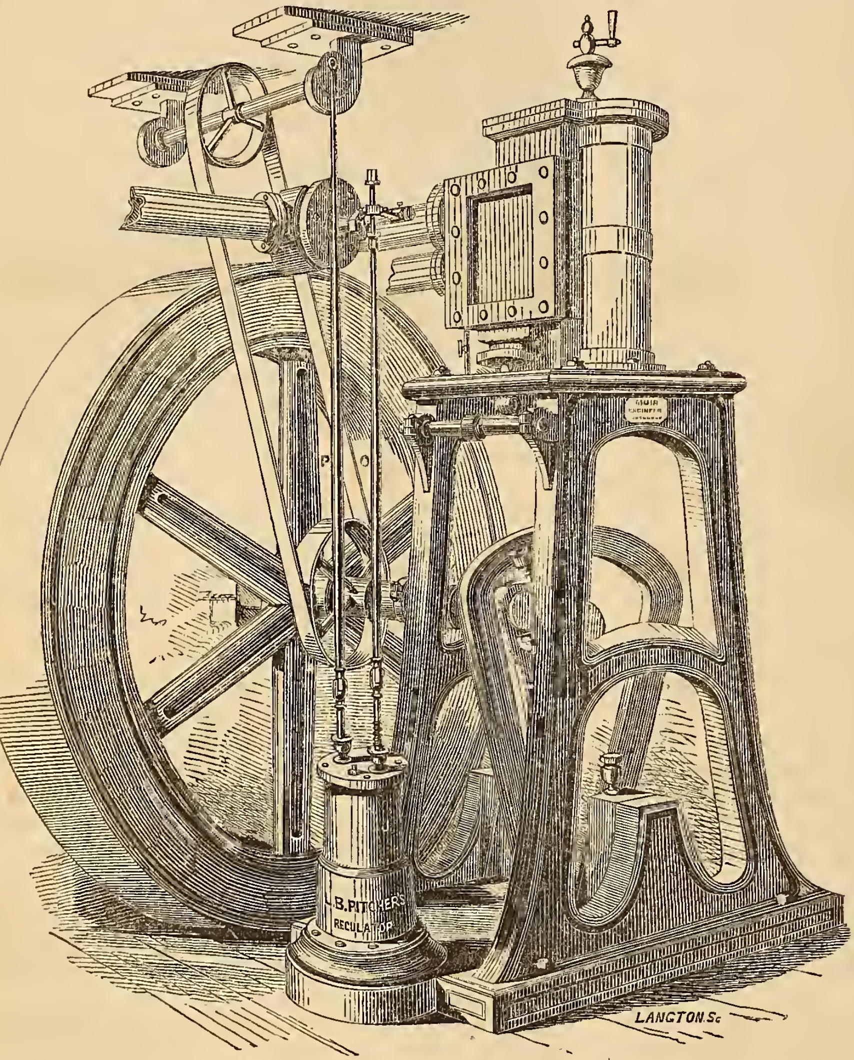


Fig. 1.

The way in which this is worked out will be readily understood from the engravings. Fig. 1 is an elevation of an engine, designed and constructed by Messrs. Muir and Co., engineers, of Manchester, to which the hydraulic governor has been attached, and which needs a notice, on its own account, in passing. It is an inverted steeple engine, an arrangement which has the merit of rendering all the parts accessible. The lower end of the steeple and the connecting rod, are, it will be perceived, guided in slots in the frame, sunk into the foundation. Fig. 2 is an elevation in section of the hydraulic portion of the regulating apparatus, to a scale of about two inches to a foot. Fig. 3 is an external view of the throttle valve-box, and the method of connecting the governor to the throttle valve; and fig. 4 is an external view of fig. 2, with the outer casing removed. The various letters of reference, in the different views, refer to the same parts.

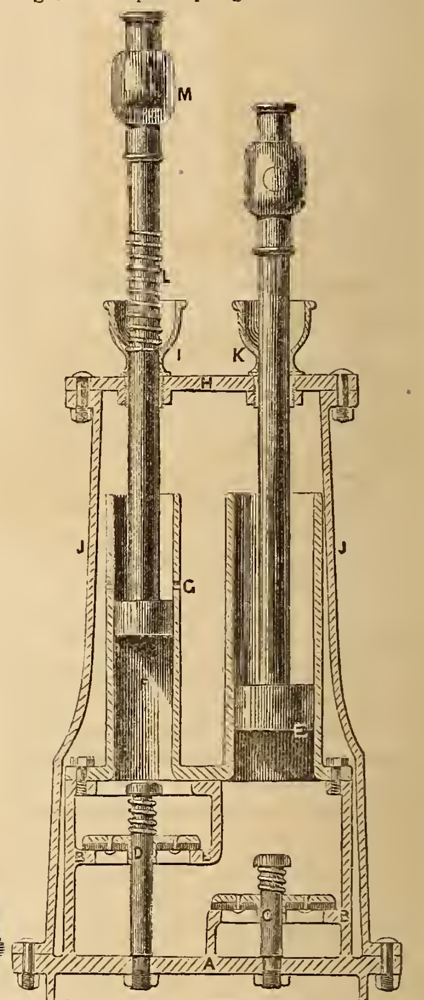


Fig. 2.

A is the base plate of the apparatus, having cast on it the valve seats, B B, C being the suction valve, and D the delivery. The details of these valves are worth noticing, as they make a very simple casting. The valve is formed of a disc of brass, to which is pinned a ring of India rubber, to obviate the concussion; they are guided by a spindle bolted through the bottom of the valve box. A collar on the spindle prevents the valve from rising too high, and a spiral spring between them causes the valve to shut promptly, without waiting for the return blow of the water. (At the Kingston Water Works, we observed that the double beat valves were loaded with lead, to answer the same purpose.) These valves will answer very well for this purpose; but, for an actual pump, they are not to be recommended, since they wear lose on the spindle after working some time, and allow the water to leak past. E is the

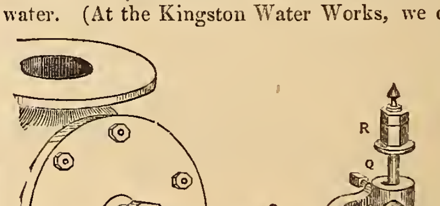


Fig. 3.

pump plunger, about $2\frac{1}{2}$ inches diameter, working four inches stroke, and 100 strokes per minute, and connected by the rod, P, to a crank overhead, arranged in any convenient way. F is the regulating piston, about 2 inches diameter, connected by the rod, O, to the throttle valve. This rod has a spiral spring, L, attached to it, to prevent the piston, F, falling further than is necessary to open the throttle valve. G is an escape hole, which, by allowing the water beneath the piston, F, to escape, prevents it rising higher than is necessary to shut the necessary, however, to remark, that the cylinders, being immersed in water, the regulating piston, F, will stand at any height that the supply of steam may render necessary; so that, when the supply of steam is once adjusted, the engine will run steadily until a further change takes place. In the ordinary centrifugal governors this result can never be attained, except by adjusting the connection with the throttle valve for every variation by hand, and thus destroying its character as a self-actor. It is obvious that this regulator may be attached to the ordinary

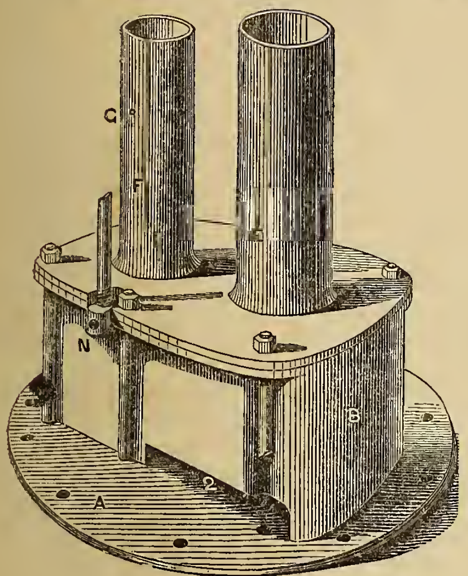


Fig. 4.

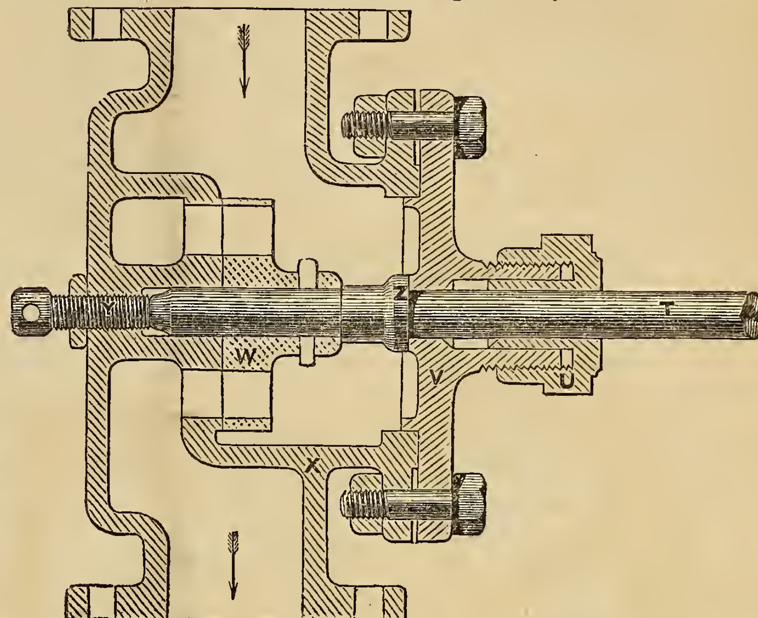


Fig. 5.

throttle valve. N (fig. 4) is the constant escape, which has an adjusting spindle carried up to the outside of the case. As a water cistern is required for the pump, the case, J, and cover, H, answer the purpose. The rods of the plunger and piston work, without packing, through the cups I and K, which catch any water that may be drawn up. When the governor is at work, the pump communicates a series of pulsations to the piston, F. On the upper end of the rod, O, are two tappets, R R, which strike the box, Q, and communicate motion, through the lever, S, to the throttle valve. Its action we have already explained; it is throttle valve, but the inventor, by experience, prefers that kind of valve shown in section, fig. 5. W is a disc keyed on the spindle, T, and having a number of openings in it, with corresponding openings in the seat. A set screw, Y, bearing against the point of the spindle, affords a means of adjusting the valve to the face, so that, whilst it is kept steam-tight, the friction shall be reduced as far as possible.

The patent governor has been tried in Manchester with the same satisfactory results as its extensive use in America ensured, and we hope soon to be able to report that it has been applied in London.

DANGER OF USING BURNING FLUIDS.

Mr. E. N. Horsford, Rumford Professor in Harvard University, has recently presented to the American Academy of Arts and Sciences, a paper on the probable causes of explosions arising from the use of spirits of turpentine, better known in this country, as camphine, and in America (with the addition of some alcohol) as burning fluid. The following is the account of the circumstances under which a fatal explosion took place, and which are remarkable, from the absence of any direct contact between the fluid and any ignited body.

The explosion took place at about eleven o'clock a.m. in an unfinished apartment—an addition to the main building, 9 feet by 10, open to the ridge pole, and 6 feet high at the eaves. A little to the right of the centre of the room (looking from the main building), was a cast-iron cooking stove, unusually thin and very smooth. At a distance of 6 feet from the stove and 3 feet from the floor on a shelf in the corner of the room, partially sheltered from the direct heat of the stove by two intervening water pails, was the tin gallon can which exploded. It was about half filled with burning fluid, and had of course been repeatedly opened in serving the lamps in daily use. The neck or larger opening of the can was stopped by a pine plug, which, although pressed to its place with difficulty from the irregular surfaces of both stopper and neck, closed the passage but imperfectly, leaving a space more than half around the stopper of a diameter continuous from top to bottom, varying from a twentieth to a twelfth of an inch. The nose or smaller opening was closed by a rag stopper.

About fifteen minutes before the accident, the girl, the unfortunate sufferer, rekindled with shavings and pine wood the fire in the stove (which since breakfast had not been replenished), and set in its place on the stove a tea kettle containing about a quart of water. The mother, a few moments before the accident, lifted one of the kettles from its place on the stove, and observed that the fire was burning well, and that a space of about two inches in diameter, on the top of the stove, was red hot. As the mother left the room, the girl tipped the tea-kettle, to pour some boiling water into a vessel on the stove hearth, by inclining, not removing the kettle. An instant after the explosion occurred. The fragments of the can were found on the floor, the bottom entirely disconnected from the sides, the nose and neck separated from the conical top, and the seam uniting the top with the sides unsoldered through two-thirds of its circumference, leaving undisturbed the part *nearest* the inner water pail. The neck, with the plug still in it, was found beyond the stove. The other parts, with the exception of the nose, were found. The nose was overlooked at the time of the accident, and afterwards found

in rubbish out of doors. The dress of the unfortunate victim of the accident, the clothing recently washed and suspended about the apartment to dry, more or less of the pine wood interior to the ridge pole, the floor about the fragments of the can, and the doors and boards in front, and at the end, enclosing the closet under the sink, all took fire. About half of the outside and corresponding inside of the water pail nearest the can, and which was empty, were burned. The outer pail, which was filled with water, is said to have been scorched a little on one side. *Only the shelf on which the can stood, and the boards in the corner on two sides of it, were not burned.*

To account for this explosion, it is only necessary to suppose that the volatilised spirit, having impregnated the atmosphere of the room, was attracted by the draft on raising the kettle. The stove appears to have been one of those on the top of which are holes for the insertion of the various utensils, and the fire having been burning vigorously, the lifting of the kettle would have the effect of increasing the current of air through the opening. In accordance with this idea, Dr. J. R. Nichols, of Haverhill, Mass., and Dr. C. T. Jackson have suggested that a train of vapour might have led to the stove from the can, have fired, and conducted flame to the can.

This suggestion is based upon facts like the following. Mr. Collins, of Haverhill, an acquaintance of Dr. Nichols, witnessed the flame from a lamp flit through a space of at least four feet to a burning fluid can. A similar phenomenon has been frequently observed in the use of ether. A lighted lamp creating a draught toward itself, has taken the exhaling ether from an open vessel along the top of the table to the flame and fired it, and the train has conducted the flash to the bottle. An officer of our navy has informed me that he once witnessed the leap of flame from a burning lamp through at least eight feet of space, from a lantern to an unstopped bottle of ether.

The can would be removed by the explosion and jump like a steam boiler from its seat. The spilling of the liquid in its course would account for the burning of the pails.

Professor Horsford has ascertained from direct experiment that spontaneous combustion from an admixture of the fluid with cotton, is highly improbable, if not impossible, and sums up an interesting paper by stating as proved:—1st. That the explosion was caused by bringing a mixture of burning fluid vapour and atmospheric air, in contact with an incandescent body.

2nd. That the evidence does not require us to believe in the spontaneous explosion of burning fluids.

We may remark, that a primary step to prevent explosions should be the compulsory use of metallic stoppers to the cans containing the fluid. These are usually screwed nipples in this country, but we have seen these lost, and a cork put in. We would suggest an arrangement on the principle of the powder flask, which cannot be left open, and which has no loose parts to be lost.

PATENT LAW AMENDMENT BILL.

The following are the more important clauses of the Patent Law Amendment Bill, which we trust will receive the royal assent before this sheet reaches the hands of our readers:—

I. The Lord Chancellor, the Master of the Rolls, Her Majesty's Attorney General for England, Her Majesty's Solicitor General for England, the Lord Advocate, Her Majesty's Solicitor General for Scotland, Her Majesty's Attorney General for Ireland, and Her Majesty's Solicitor General for Ireland, for the time being respectively, together with such other person or persons as may be from time to time appointed by Her Majesty, as hereinafter mentioned, shall be commissioners of patents for inventions; and it shall be lawful for Her Majesty, from time to time, by warrant under her royal sign manual, to appoint such other person or persons as she may think fit to be a commissioner or commissioners as aforesaid; and every person so appointed shall continue such commissioner during Her Majesty's pleasure; and all the powers hereby vested in the commissioners may be exercised by any three or more of them, the Lord Chancellor or Master of the Rolls being one.

VI. Every petition for the grant of letters patent for an invention, and the declaration required to accompany such petition, shall be left at the office of the commissioners, and there shall be left therewith a statement in writing, hereinafter called the provisional specification, signed by or on behalf of the applicant for letters patent, describing the nature of the said invention; and the day of the delivery of every such petition, declaration, and provisional specification shall be recorded at the said office, and endorsed on such petition, declaration, and provisional specification, and a certificate thereof given to such applicant or his agent; and all such petitions, declarations, and provisional specifications shall be preserved in such manner as the commissioners may direct, and a registry thereof and of all proceedings thereon kept at the office of the commissioners.

VII. Every application for letters patent made under this act shall be referred by the commissioners, according to such regulations as they may think fit to make, to one of the law officers.

VIII. The provisional specification shall be referred to the law officer, who shall be at liberty to call to his aid such scientific or other person as he may think fit, and to cause to be paid to such person by the applicant such remuneration as the law officer shall appoint; and if such law officer be satisfied that the provisional specification describes the nature of the invention, he shall allow the same, and give a certificate of his allowance, and such certificate shall be filed in the office of the commissioners, and thereupon the invention therein referred to may, during the term of six months from the date of the application for letters patent for the said invention, be used and published without prejudice to any letters patent to be granted for the same, and such protection from the consequences of use and publication is hereinafter referred to as provisional protection: provided always, that in case the title of the invention or the provisional specification be too large or insufficient, it shall be lawful for the law officer to whom the same is referred to allow or require the same to be amended.

IX. The applicant for letters patent for an invention, instead of leaving with the petition and declaration a provisional specification as aforesaid, may, if he think fit, file with the said petition and declaration an instrument in writing under his hand and seal (hereinafter called a complete specification), particularly describing and ascertaining the nature of the said invention, and in what manner the same is to be performed, which complete specification shall be mentioned in such declaration, and the day of the delivery of every such petition, declaration, and complete specification shall be recorded at the office of the commissioners, and endorsed on such petition, declaration, and specification, and a certificate thereof given to such applicant or his agent, and thereupon, subject and without prejudice to the provisions hereinafter contained, the invention shall be protected under this act for the term of six months from the date of the application, and the applicant shall have, during such terms of six months, the like powers, rights, and privileges as might have been conferred upon him by letters patent for such invention, issued under this act, and duly sealed as of the day of the date of such application; and during the continuance of such powers, rights, and privileges under this provision, such invention may be used and published without prejudice to any letters patent to be granted for the same; and where letters patent are granted in respect of such invention, then in lieu of a condition for making void such letters patent, in case such invention be not described and ascertained by a subsequent specification, such letters patent shall be conditioned to

become void, if such complete specification, filed as aforesaid, does not particularly describe and ascertain the nature of the said invention, and in what manner the same is to be performed; and a copy of every such complete specification shall be open to the inspection of the public, as hereinafter provided, from the time of depositing the same, subject to such regulation as the commissioners may make.

X. In case of any application for letters patent for any invention, and the obtaining upon such application of provisional protection for such invention, or of protection for the same, by reason of the deposit of a complete specification as aforesaid in fraud of the true and first inventor, any letters patent granted to the true and first inventor of such invention shall not be invalidated by reason of such application, or of such provisional or other protection as aforesaid, or of any use or publication of the invention subsequent to such application, and before the expiration of the term of such provisional or other protection.

XI. Where any invention is provisionally protected under this act, or protected by reason of the deposit of such complete specification, as aforesaid, the commissioners shall cause such provisional protection or such other protection as aforesaid to be advertised in such manner as they may see fit.

XII. The applicant for letters patent, so soon as he may think fit after the invention shall have been provisionally protected under this act, or where a complete specification has been deposited with his petition and declaration, then so soon as he may think fit after such deposit, may give notice at the office of the commissioners of his intention of proceeding with his application for letters patent for the said invention, and thereupon the said commissioners shall cause his said application to be advertised in such manner as they may see fit; and any persons having an interest in opposing the grant of letters patent for the said invention shall be at liberty to leave particulars in writing of their objections to the said application at such place, and within such time and subject to such regulations as the commissioners may direct.

XIII. So soon as the time for the delivery of such objections shall have expired, the provisional specification or complete specification (as the case may be) and particulars of objection (if any) shall be referred to the law officer to whom the application has been referred.

XIV. It shall be lawful for the law officer to whom any application for such letters patent is referred, if he see fit, by certificate under his hand, to order by or to whom the costs of any hearing or inquiry upon any objection, or otherwise in relation to the grant of such letters patent, or in relation to the provisional [or *other*] protection acquired by the applicant under this act, shall be paid, and in what manner and by whom such costs are to be ascertained; and if any costs so ordered to be paid be not paid within four days after the amount thereof shall be so ascertained, it shall be lawful for such law officer to make an order for the payment of the same, and every such order may be made a rule of one of Her Majesty's superior courts at Westminster.

XV. It shall be lawful for such law officer, after such hearing, if any, as he may think fit, to cause a warrant to be made for the sealing of letters patent for the said invention, and such warrant shall be sealed with the seal of the commissioners, and shall set forth the tenor and effect of the letters patent thereby authorised to be granted, and such law officer shall direct the insertion in such letters patent of all such restrictions, conditions, and provisoes as he may deem usual and expedient in such grants, or necessary in pursuance of the provisions of this act; and the said warrant shall be the warrant for the making and sealing of letters patent under this act, according to the tenor of the said warrant: provided always, that the Lord Chancellor shall and may have and exercise such powers, authority and discretion, in respect to the said warrant, and letters patent therein directed to be made under this act, as he now has and might now exercise with respect to the warrant for the issue under the great seal of letters patent for any invention, and with respect to the making and issuing of such letters patent; and the writ of *scire facias* shall lie for the repeal of any letters patent issued under this act, in the like cases as the same would lie for the repeal of letters patent which may now be issued under the great seal.

XXIX. The commissioners shall cause true copies of all specifications (other than provisional specifications), disclaimers, and memoranda of alterations filed under or in pursuance of this act, and of all provisional specifications after the term of the provisional protection of the invention has expired, to be open to the inspection of the public at the office of the commissioners, and at an office in Edinburgh and Dublin respectively, at all reasonable times, subject to such regulations as the commisioners may direct.

XXX. The commissioners shall cause to be printed, published, and sold at such prices and in such manner as they may think fit, all specifications, disclaimers, and memoranda of alterations deposited or filed under this act, and such specifications (not being provisional specifications), disclaimers, and memoranda respectively, shall be so printed and published as soon as conveniently may be after the filing thereof respectively, and all such provisional specifications shall be so printed and published as soon as conveniently may be after the expiration of the provisional protection obtained in respect thereof; and it shall be lawful for the commissioners to present copies of all such publications to such public libraries and museums as they may think fit, and to allow the person depositing or filing any such specification, disclaimer, or memorandum of alteration to have such number, not exceeding twenty-five, of the copies thereof so printed and published, without any payment for the same, as they may think fit.

XXXI. It shall be lawful for the Lord Chancellor and the Master of the Rolls to direct the enrolment of specifications, disclaimers, and memoranda of alterations heretofore or hereafter enrolled or deposited at the Rolls Chapel-office, or at the Petty Bag-office, or at the Enrolment-office of the Court of Chancery, or in the custody of the Master of the Rolls, as keeper of the public records, to be transferred to and kept in the office appointed for filing specifications in Chancery under this act.

XXXII. The commissioners shall cause indexes to all specifications, disclaimers, and memoranda of alterations heretofore or to be hereafter enrolled or deposited as last aforesaid to be prepared in such form as they may think fit, and such indexes shall be open to the inspection of the public at such place or places as the commissioners shall appoint, and subject to the regulations to be made by the commissioners; and the commissioners may cause all or any of such indexes, specifications, disclaimers, and memoranda of alterations, to be printed, published, and sold in such manner and at such prices as the commissioners may think fit.

XXIII. Copies, printed by the printers to the Queen's Majesty, of specifications, disclaimers, and memoranda of alterations shall be admissible as evidence, and deemed and taken to be *primâ facie* evidence of the existence and contents of the documents to which they purport to relate in all courts and in all proceedings relating to letters patent.

XXXIV. There shall be kept at the office appointed for filing specifications in Chancery under this act a book or books, to be called "The Register of Patents," wherein shall be entered and recorded, in chronological order, all letters patent granted under this act, the deposit or filing of specifications, disclaimers, and memoranda of alterations filed in respect of such letters patent, all amendments in such letters patent and specifications, all confirmations and extensions of such letters patent, the expiry, vacating, or cancelling such letters patent, with the dates thereof respectively, and all other matters and things affecting the validity of such letters patent as the commissioners may direct, and such register, or a copy thereof, shall be open at all convenient times to the inspection of the public, subject to such regulations as the commissioners may make.

XXXV. There shall be kept at the office appointed for filing specifications in Chancery under this act a book or books, entitled "The Register of Proprietors," wherein shall be entered, in such manner as the commissioners shall direct, the assignment of any letters patent, or of any share or interest therein, any licence under letters patent, and the district to which such licence relates, with the name or names of any person having any share or interest in such letters patent or licence, the date of his or their acquiring such letters patent, share, and interest, and any other matter or thing relating to or affecting the proprietorship in such letters patent or licence; and a copy of any entry in such book, certified under such seal as may have been appointed, or as may be directed by the Lord Chancellor to be used in the said office, shall be given to any person requiring the same, *on payment of the fees hereinafter provided;* and such copies so certified shall be received in evidence in all courts and in all proceedings, and shall be *primâ facie* proof of the assignment of such letters patent, or share or interest therein, or of the licence or proprietorship, as therein expressed: provided always, that until such entry shall have been made, the grantee or grantees of the letters patent shall be deemed and taken to be the sole and exclusive proprietor or proprietors of such letters patent, and of all the licences and privileges thereby given and granted; that certified duplicates of all entries made in said register of proprietors shall forthwith be transmitted to the office of the commissioners in Edinburgh and Dublin, where the same shall also be open to the inspection of the public; and any writ of *scire facias* to repeal such letters patent may be issued to the sheriff of the county or counties in which the grantee or grantees resided at the time when the said letters patent were granted; and in case such grantee or grantees do not reside in England or Wales, it shall be sufficient to file such writ in the Petty Bag-office, and serve notice thereof in writing at the last known residence or place of business of such grantee or grantees; and such register or a copy shall be open to the inspection of the public at the office of the commissioners, subject to such regulations as the commissioners may make.

Schedule of Fees and Stamp Duties.

On leaving petition for grant of letters patent	£5	0	0
On notice of intention to proceed with the application ..	5	0	0
On warrant of law officer for letters patent (stamp)	5	0	0
On sealing of letters patent	5	0	0
On filing specification	5	0	0
Cost of three years' patent	£25	0	0
At or before the expiration of the 3rd year	40	0	0
On certificate of payment of the fee, &c. (stamp)	10	0	0
Cost of seven years' patent	£75	0	0
At or before the expiration of the 7th year	80	0	0
On certificate of payment of the fee, &c. (stamp)	20	0	0
Cost of 14 years' patent for the three kingdoms	£175	0	0
On leaving notice of objections	£2	0	0
Every search and inspection	0	1	0
Entry of assignment or licence	0	5	0
Certificate of assignment or licence	0	5	0
Filing application for disclaimer	5	0	0
Caveat against disclaimer	2	0	0

DIMENSIONS OF STEAM SHIPS BUILT FOR THE TURKISH GOVERNMENT,

BY MESSRS. T., J., AND R. WHITE, OF COWES.

NAME OF SHIP.	Tonnage.		Power of Engines.	Light Draft.		Load Draft.		Weight of Ship.	Tons of Cargo.	Displacement.		Maker of Engines.	Kind of Engines and Boilers.	Nominal power.	Diameter of Cylinders.	Length of Stroke.	Diameter of Paddle-wheel.	Length of Boards.	No of Boilers.	No. of Furnaces.	Steam pressure.
	O. M	N. M		Forwd.	Aft.	Forwd.	Aft.			Light line.	Load line.										
VASSITEI TIDJARET. Length, 195 feet. Beam 31 feet 8 inches.	936	784	300	ft. in. 8 5 rigged c	ft. in. 9 9 omplete	Engin 9ft. 7in. with 50 to 10 1 loa 12 $11\frac{1}{4}$	es in 12ft. 3in. ns coals 12 6 ded 12 $11\frac{1}{2}$	470	100	470 8 tns. 7 cwt. per inch	1,350 11 tons 3 cwt. per inch.	Maudslay Sons and Field.	Double cylinder and tubular.	Two 150s	Two in. $46\frac{1}{2}$	ft. in. 5 0	ft. in. 24 0	ft. in. 10 0	2	8	9
NUBAISH TIDJARET. Length, 139f. 10in. Keel, 136f. 6in. Beam, 25f. $1\frac{1}{2}$in. Depth, 13f. 9in.	$407\frac{67}{94}$	304	200	5 7 with en 7 0	6 10 gine in 8 11	with 72 to 8 3 with 120 t 9 8	ns coals 9 9 ons coals 10 11	185 and engines 342	72	185	410 tons to 8 feet average.	ditto.	Double cylinder and flue.	Two 100s	Two $39\frac{1}{2}$	4 0	16 6	10 0	2	6	7
SHAHPERE. Length aloft, 182 feet. Breadth, 27 feet 3 inches. Depth, 17 feet 3 inches.	750	667	240	6 9 steam up 8 4	7 5 & 5t. coal 9 0	77 ts. coal 8 8 10 ts. mor 9 1 400 tons goods & 70 11 9	s & water 10 8 e water 10 11 measure tns. coals 12 0	375	70	375	1,116 to 12 feet, 10 tns. 6 cwt. per inch at load line.	ditto.	Oscillating and flue.	Two 120s	$59\frac{1}{2}$	4 6	20 0	7 10	2	12	7
No. 1—GREYHOUND. Length, 120 feet. Breadth, 18 feet. Depth, 9 feet 7 inches. (A sister vesssel, same size.)	188	...	60	launchi 2 7 with m 2 9 50 tons b fit 3 11	ng draft 4 4 asts in 4 $5\frac{1}{2}$ allast & ted 5 7	66 tons and 6 0	coals engine 7 0	...	...	132 engines in at 4ft. 5in.	194 at 6 feet & 66 tons coal.	ditto.	ditto.	Two 30s	32	2 10	13 0	6 0	1	2	7
No. 7—Two Tugs. Length, 88 feet. Breadth, 18 feet 6 inches. Depth, 8 feet 2 inches.	140	...	80	masted 2 11 35 tons 3 7	& rigged 3 9 ballast 4 9	50 tons 5 10	coals 6 10	...	...	50	115 at 6 feet.	ditto.	ditto.	Two 40s	36	3 0	12 0	7 0	1	2	7
No. 3—Four vessels with deck-houses. Length 120 feet. Breadth, 18 feet. Depth, 8 feet 2 inches.	188	...	60	without 2 8 60 tons 3 9	masts 3 $11\frac{1}{2}$ ballast 4 11	engines tons pat 4 $10\frac{1}{2}$	and 25 ent fuel 5 $10\frac{1}{2}$	...	...	132	194	ditto.	ditto.	Two 30s	32	2 10	13 0	6 0	1	2	7

THE PACIFIC ROYAL MAIL STEAM NAVIGATION COMPANY'S NEW IRON STEAM VESSELS, "LIMA" AND "QUITO."

Built and fitted by Mr. Robert Napier, Glasgow, 1851.

Dimensions.	"Lima." ft. tenths.	"Quito." ft. tenths.
Length on deck	249 5	248 7
Breadth on do., amidships	29 2	29 0
Depth of hold, do.	17 1	17 0
Length of poop	68 6	68 8
Breadth of do.	29 2	29 7
Depth of do.	7 7	8 0
Length of engine-space	85 4	85 6
Tonnage.	Tons.	Tons.
Hull	$955\frac{78}{100}$	$944\frac{29}{100}$
Poop	$166\frac{92}{100}$	$176\frac{91}{100}$
Total	$1,122\frac{70}{100}$	$1,121\frac{20}{100}$
Contents of engine-space	$461\frac{69}{100}$	$456\frac{71}{100}$
Register	$661\frac{1}{100}$	$664\frac{49}{100}$

A pair of side-lever engines of 412 horse (nominal) power: diameter of cylinders, 73 inches × 6 feet stroke; diameter of air-pumps, 41 inches × 3 feet 3 inches stroke; diameter of paddle-wheels, extreme, 27 feet, and 26 feet 4 inches effective; 20 floats, 8 feet 9 inches × 2 feet 4 inches. (All the particulars are similar to those of the *Santiago*, in the June number.) The *Lima* was launched from the building-yard, Govan, September the 12th. Draft of water at launching, forward, 5 feet 2 inches, and 6 feet 10 inches aft. On the trial from Greenock to the Bell-buoy, Liverpool, in November last, a distance of 202½ miles, made the run in 13 hours and 15 minutes, having 500 tons of pig iron on board.

The *Quito* was launched from the building-yard, Govan, on the 12th of November; the draft of water forward, 5 feet 1 inch, and 6 feet 11 inches aft. Sailed from Liverpool February the 7th, for Madeira, Rio de Janeiro, and Valparaiso, having 70 passengers on board; both vessels have made quick passages to their destinations.

DESCRIPTION.

A full female figure-head (*Lima*); a full male figure-head (*Quito*); mock quarter-galleries; clipper bow; standing bowsprit; two masts; brig-rigged; square-sterned and clinch-built vessels; two decks and a poop, with a top-gallant forecastle. Port of Liverpool.

Lima, commander—Mr. John Williams.
Quito, do. Mr. W. B. Wells.

THE LIVERPOOL AND DUBLIN SCREW STEAM SHIPPING COMPANY'S NEW IRON VESSEL, "TIMES."

Built and fitted by Messrs. Smith and Rodger, engineers and iron ship-builders, Glasgow, 1851.

Dimensions.	ft. tenths.
Length on deck	158 5
Breadth on do., amidships	20 1
Depth of hold, do.	13 6
Length of engine-space	51 0
Breadth of do.	18 2
Depth of do.	13 6
Tonnage.	Tons.
Hull	$301\frac{91}{100}$
Contents of engine-space	$119\frac{85}{100}$
Register	$182\frac{6}{100}$

A pair of steeple-engines (on Mr. David Napier's 4-piston-rod patent principle), of 50 horses nominal power: diameter of cylinders, 30 inches × 2 feet 6 inches stroke, having a double-acting air-pump; screw with two blades, 9 feet diameter and 11 feet pitch; diameter of driving-wheel, 7 feet 9 inches, and 70 teeth; diameter of pinion, 3 feet 9 inches, and 34 teeth; pitch, 4 inches; breadth of teeth, 13 inches. One tubular boiler: length, 10 feet 6 inches; breadth, 9 feet 1 inch; depth, 11 feet 6 inches. Steam-chest: length above, 6 feet 6 inches; ditto below, 7 feet 6 inches; breadth, 5 feet; depth, 3 feet. Two cylindrical furnaces, 3 feet 8 inches × 7 feet; having 196 tubes, diameter, $2\frac{3}{4}$ inches; capacity of coal-bunkers, 22 tons. Has a round-house amidships: length, 34 feet; breadth, 12 feet 8 inches; height, 6 feet 8 inches; and accommodates 28 first-class passengers. Also a round-house aft: length, 18 feet; breadth, 10 feet; height, 6 feet 8 inches; and accommodates 8 passengers. Total, 36 passengers. Launched at 20 minutes after 3 p.m., August the 15th. Launching-draft of water (mean), 5 feet 2 inches; displacement, 145 tons; average steam-pressure, 15 lbs. per square inch. Engines making 50 revolutions per minute; the average passages between Liverpool and Dublin (123 miles) being 10½ hours.

DESCRIPTION.

A shield figure head; imitation galleries; square-sterned and clinch-built vessel; clipper bow; one deck (and 'tween decks); standing bowsprit; three masts; schooner-rigged. Port of Glasgow; commander, Mr. J. Corry.

SHIPBUILDING.

WHITEHAVEN.

Messrs. L. Kennedy and Co., ship-builders, have at present on the stocks a new ship in a forward state, to class 13 years, having a poop and a top-gallant forecastle.

Dimensions.	ft.	in.
Length of keel and fore-rake	147	6
Breadth of beam	31	11
Depth of hold	21	1
Tonnage	$648\frac{9}{94}$ tons.	

For the foreign trade.

Also upon the stocks, a clipper-ship, to class 13 years, flush on deck.

Dimensions.	ft.	in.
Length of keel and fore-rake	141	6
Breadth of beam	26	0
Depth of hold	17	0
Tonnage	$449\frac{73}{94}$ tons.	

Also for foreign trade.

DUNDEE.

Messrs. J. and A. Calman, ship-builders, have on the stocks, building, a ship or barque, in a very forward state, adapted either for a screw or a sailing vessel.

Dimensions.	ft.	in.
Length, extreme	140	0
„ of keel and fore-rake	129	0
Breadth of beam	24	2
Depth of hold	15	0
Tonnage, O.M.	$356\frac{33}{94}$ tons.	
Do., N.M.	330 „	

Adapted for the foreign trade.

PAISLEY.

June 6th there was launched from the building-yard of Messrs. Blackwood and Gordon, engineers and iron ship-builders, a very handsomely modelled screw steam-vessel, named the *Best Bower*, intended for the Leith and Hamburg trade, and will sail as a consort to the screw-steamer, *Holyrood;* to be commanded by Captain Robert Cook. It was estimated that there were no fewer than 20,000 to 30,000 persons present at the launch, this being the first built at the port of Paisley since the *Petrel* was launched there, in 1845, and the first built for screw-propulsion. The launch was effected in fine style.

Dimensions.	ft.
Length of keel and fore-rake	190
Breadth of beam	26
Depth of hold	16
Tonnage	$627\frac{9}{94}$ tons.

With a pair of engines, of 120 horses power, collectively; the screw is 10 feet 6 inches in diameter, and 12 feet 6 inches pitch.

June the 6th the keel of a paddle wheel river-steamer was laid down on the site of the one launched, for the Greenock Steam-packet Company, to be running in August.

Dimensions.	ft.	in.
Length of keel and fore-rake	165	0
Breadth of beam	16	0
Depth of hold	7	3
Tonnage	$211\frac{57}{94}$ tons.	

INCH-GREEN (PORT-GLASGOW).

Messrs. Laurence, Hill, and Co., iron ship-builders, launched from their building-yard, on the 7th of June, a paddle river-steamer, named the *Dunoon*, to ply between Greenock and Dunoon and Rothsay, &c., with passengers, in connection with the Glasgow, Paisley, and Greenock branch of the Caledonian Railway. The machinery is by Messrs. Scott, Sinclair, and Co., Greenock. This is the third iron vessel launched by this firm.

REVIEWS.

Elements of Practical Geometry, for Schools and Workmen. By the Author of *Arithmetic for Young Children.* London: Groombridge.

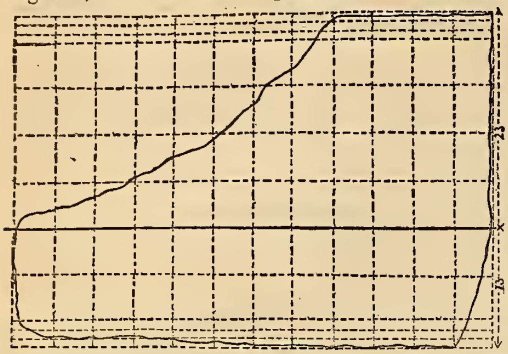
We should consider it a greater honour to be the author of a single good elementary scientific work, than of all the brilliant "leaders" that the press can boast of. Without saying that the work before us comes up to our estimate of what such a work might be, we can express our approval of its general tendency. It rather seems to be deficient in examples of the application of the problems to the things of every-day life, if it is intended to be put into the hands of a teacher; and a greater degree of interest might surely be imparted to the notable 47th of Euclid, than is contained in the following rule:—"*To make a square equal to any two other squares.* Make a right angle with one side of each of the two smaller squares, join the distant ends of the sides: and on this third line draw a square, which will cover an area equal to that of both the smaller squares." We suspect the author can do better than this, if he tries.

The Dictionary of Domestic Medicine and Household Surgery. By Spencer Thomson, M.D., &c., &c. Part I. London: Groombridge.

Health, which according to popular proverbs, ought to take precedence both of wealth and wisdom, is usually sacrificed quite as often from ignorance as from any other cause. More enlightenment on sanitary matters has done a great deal, but much yet remains to be done, which may be materially accelerated by the publication of sound information in a popular form. Mr. Thompson's work seems well adapted for the purpose.

INDICATOR-DIAGRAM FROM THE "EMPIRE STATE."

We have received from our New York correspondent a number of diagrams, of which the accompanying one is a specimen. It is from the



Empire State, running in Long Island Sound, before the valves were considered to be finally adjusted. A single beam-engine, 75-inch cylinder by 12 feet stroke, making 18 revolutions, or 432 feet per minute. Steam in boiler, 25 lbs.; cut-off at one-third; average pressure, 24·75. The nominal horse-power, according to the English rule, would be 270. The indicated power is 1,430. This is about the best example of a marine-engine diagram that we have seen. The cylinder-valves, of course, are double-beat valves.

We have also a somewhat similar diagram from the *Union*, with a pair of side lever-engines, 60 inches diameter and 7 feet stroke, making 16 revolutions. Steam, $22\frac{1}{2}$ lbs.; cut-off at $\frac{5}{14}$th of the stroke.

AMERICAN AND ENGLISH STEAMERS.

(From the *New York Sun*.)

On the 3rd of September last there appeared in the columns of the *Sun* a letter, written by its present proprietor, on the occasion of his return by the steamer *Atlantic*, from a short European tour, in the course of which the following remarks, respecting American and English ocean steamships and machinery were made:—

"During my absence, I have seen frequent notices in English papers, of great improvements made in the *Atlantic's* engines, at the time of her repair in Liverpool, from which it was either inferred, or stated, that a great increase in her speed might thereafter be expected. Of course I felt interested in learning what these *English* improvements could be; and placing myself under the care of Mr. Rogers, the chief engineer (who I must thank for his kind attention), I have inspected minutely the engine-room. *Not one solitary alteration has been made.* The new pillar blocks and shafts were made of increased size and strength—nothing more.

"From Mr. Rogers, who, I am told, is one of the very best engineers that America can boast of (I can certify to his being a working one), I gathered some facts, which, with a premise of my own, will be generally interesting.

"Since the first application of steam to the propulsion of vessels, the English have been constantly engaged in perfecting engines for marine use, while it is hardly ten years since American attention was first directed especially to ocean navigation. The general result in speed is known; but there are few who understand that, in the short experience we have thus far had, three very important improvements have been made by us in the bracing and arrangement of engines.

"In building the last *fast* boats (the *Asia* and *Africa*), the Cunard line adopted two of these American improvements; and in the extra fast boats now building, they are to go the whole figure, and fashion the engines entirely after the most improved American models. More than this, one of the engineers of the Royal Navy (his name I have forgotten), after scrutinising closely the American engines, was so highly pleased with them, as to say to Mr. Rogers that it should be adopted for the next naval vessel built, if any exertions of his could effect that object.

"These are facts which Americans may remember to the nation's advantage, when American skill in steamer-building is called in question."

This portion of the letter attracted much attention in England, being copied into the journals, and commented upon by the editors or correspondents. In the London *Builder* only was its accuracy questioned, and there not by its judicious editor, but by a very indiscreet correspondent, as the sequel will show. These contradictions did not meet our eyes at the time, and it is but recently that we have obtained a copy of the original publication of them. As the matter is one of more than ordinary importance, we publish the letter in the *Builder*, that its wilful falsities may be the more apparent, when placed in contrast with the truth:—

BRITISH AND AMERICAN STEAMERS.

In your number of the 4th inst., you quoted an extract from an American paper, in which it is stated that improvements made in the steam-engine by Americans have been adopted in building the "last fast" boats of the Cunard line, and that in the "extra fast" boats of the same line now in course of construction, "they are to go the whole figure, and fashion the engines entirely after the most approved American models." By giving currency, as you have done, on this and other recent occasions, without comment, to the overweening estimates which the Americans form of their own superiority, you appear to me, Mr. Editor, to do much towards weakening the well-founded confidence which has hitherto been entertained in the perfection of British machinery, *thereby injuring British interests, particularly with reference to the demands for engines from foreigners.*

It is time, therefore, that the real facts of the case respecting the manufacture of the engines on board Collins's American line of steamers (the vessels more immediately alluded to in the American newspaper) should be made known, which I now do from undoubted authority, and, as regards some of the particulars, from my own knowledge, and which are as follow:

The United States Government, perceiving the failure of all the attempts that had been made to establish an American line of Atlantic steamers, which should compete, in point of speed and efficiency, with the Cunard line, and deeming it of the greatest national importance that this inferiority should no longer continue, subsidised, with a large annual subvention, Collins's line (besides, it is believed, giving pecuniary aid, in some shape or other, towards the construction of the vessels), on condition that no expense should be spared in obtaining the most perfect and efficient engines that could be constructed; and as there was, at that time (although it is only two years ago) no manufacturer in the United States who could make engines fulfilling these conditions, the contractors for the American line turned their views towards the Clyde, and obtained permission from the proprietors of the Cunard line to take mouldings or castings of every part, even to the minutest particular, of the engines constructed by Napier, of Glasgow, on board the largest of their vessels; and, in order that nothing might be wanting to make the engines equal to those in the Cunard steamers, the contractors imported men from the manufactories on the Clyde, for the purpose of making the engines in New York, so that they might be of national or American fabric.

As, therefore, the last constructed and fastest of the American ocean-going steamers are made entirely after the British model and by "Britishers," you will perceive, Mr. Editor, how likely it is that the Cunard vessels, now in course of construction, are to be fitted with engines made after the American model. Where, indeed, have the Americans anything better to show than the engines on board the Collins line, which are made after the British model?

BRITANNICUS.

This letter was copied extensively into the English journals, as an anchor of hope, and, for effect, throughout the continent of Europe. It can easily be seen how anxiously Englishmen desired the impression to prevail that the Americans were copyists; and that, for the signal triumphs of their ocean steamers, during the summer of 1851, they were indebted to English genius, skill, and generous favour. The letter of Britannicus met the eye of James Brown, Esq., President of the Collins line, in the columns of *Galignani's Messenger*, of Paris, and he brought it to the notice of Stillman, Allen and Co., the builders of the engines for the Collins steamers.

Their reply, which we now subjoin, furnishes the most satisfactory

confirmation of every word in our letter, and an overwhelming refutation of the sweeping mis-statements of Britannicus. In place of any agent or member of the firm of S. A. and Co., ever having visited "the Clyde," or the establishment of "Napier, of Glasgow," a son or brother of this same Napier, some time ago, came here and inspected every part of the Novelty Works, by invitation and permission of the proprietors. One other fact, in favour of the Collins steamers' machinery, may here be given. While it only requires one man to work these engines, two or three are employed to set those of the Cunard steamers in motion. The only similarity between the machinery of the two lines is, that they are both "side lever engines."

But here is the letter, and it requires no comment at our hands. We trust the *Builder*, and other papers which inserted the statements of Britannicus, will be candid and honourable enough to insert their refutation.

James Brown, Esq.—Dear Sir,—I enclose the piece cut from *Galignani's Messenger*. It is quoted from the London *Builder*, and it is strange indeed that misrepresentations so utterly without any foundation should find a place in any journal of any respectability.

The writer states, as "*from undoubted authority, and, as regards some particulars, from his own knowledge*," *that* "*the contractors of the American line obtained permission from the proprietors of the Cunard line to take mouldings or castings of every part, even to the minutest particular, of the engines constructed by Napier, of Glasgow, on board the largest of their vessels.*"

It does not seem to have occurred to the author of this remarkable assertion, whether it was very probable, that the proprietors of the Cunard line would feel disposed to render any such aid to a rival company, nor does he explain by what mechanical process the ignorant Yankees were able "to take mouldings or castings of every part, even to the minutest details of engines," on board of a vessel.

How utterly without foundation this assertion is, any may see, who will barely look at the two sets of engines; even a casual glance is enough to show their utter dissimilarity throughout, in plan, and in detail; not one piece of one is like one piece of the other; and on this point the engines speak for themselves. They differ about as much as two sets of side-lever engines can differ.

But, according to this writer, the possession of all the mouldings or castings was not enough, and, therefore (he goes on to say), "in order that nothing might be wanting to make the engines equal to those in the Cunard steamers, the contractors imported men from the manufactories on the Clyde, for the purpose of making engines in New York."

A few facts will show the grossness of this misrepresentation, and exhibit the purely American character of the engines we built for your company.

Of the proprietors of our concern, every one is a native of the United States, and acquired here whatever mechanical skill or knowledge he possesses.

Of our foremen, every man (with one exception) was born in the United States, learned his trade in this country, and whatever they have done, in connection with marine engines, has been at our works. The one exception referred to has been employed at our works for the last nineteen years, and never did any work for marine engines in any other place.

The draughtsmen who made the drawings are our pupils, and acquired all the knowledge and experience they have, in connection with steam-engines, in our drawing room. The men who superintended the setting of the engines are also natives of the United States, were once our apprentices, and acquired at our works whatever skill and experience they have.

No man was ever imported from the manufactories of the Clyde, or from any other quarter, with reference to those engines, and neither in the preparation of the plans, nor in the construction of the work, did we ever receive any assistance, direct or indirect, from any engineer on the banks of the Clyde, or from any other part of Great Britain.

In short, the engines were made of American iron, forged or melted with American coal, they were planned by American heads, and put together by American hands. In plan, and many important features, they differ, not merely from the Cunard engines, but also from any ever built on the other side of the Atlantic, and we are happy to find that their excellence is so far acknowledged, as to render our English friends anxious to claim the credit of having produced them.

Respectfully yours,
STILLMAN, ALLEN & Co.

Novelty Iron Works, New York, *Dec.* 23, 1851.

[We should not have occupied our columns with the whole of this correspondence, had we not been desirous of giving our friends on the other side of the Atlantic the most ample means in our power of exposing the misrepresentations in question. The letter of Britannicus bears on the face of it evidence of being written by a person utterly unacquainted with marine engineering, and this ought to have led the conductors of the *Builder* to make inquiry before they endorsed such statements, by giving them currency. It may be some consolation for Messrs. Stillman, & Co. to know, that our contemporary was never yet suspected of being an engineering authority, in this part of the world; still a very insignificant hand may set a stone rolling that will do a vast deal of mischief.

In reference to the statement as to the number of men required to handle the Cunard engines, it is well known that the above account is under the mark. We may also add, that Messrs. Maudsley, Sons, and Field, have adopted the American system of double beat valves, in the steamer they have lately fitted for the West India Mail Company.

Ed. *Artizan.*]

CHANNELS FOR INVESTMENT.

LIST OF NEW COMPANIES RECENTLY ESTABLISHED OR PROPOSED.

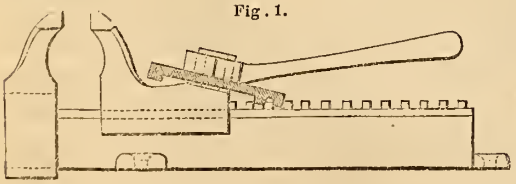
	Amount of Share.	No. of Shares.	Capital.
RAILWAY COMPANIES.			
Madras	£20	25,000	£500,000
Plymouth and Tavistock	20	7,500	150,000
Severn Valley	25	14,000	350,000
Belgian American Atlantic Railway and Emigration	5	100,000	500,000
West Flanders	10	20,000	200,000
MINING COMPANIES.			
Quartzburgh Gold	10*s.*	60,000	30,000
Megantic Copper			
Australian Cordillera Gold and Copper	£1	60,000	60,000
New South Wales Gold Mines	1	60,000	60,000
North Wales Consolidated	1	50,000	50,000
Royal Australian Gold Refining and Mining			
Arundel United Copper	1	10,000	10,000
The Connemara (Ireland) Copper and Silver-lead	1	15,000	15,000
Le Mineur Franco-Anglo Californian Gold	1	160,000	160,000
Australian General Mining and Emigration	1	150,000	150,000
Exhall Coal	1	50,000	50,000
Carberry West (Ireland) Silver, Copper	10*s.*	30,000	15,000
Wheal Atley, Silver-lead and Copper	£1	6,000	6,000
North Wheal Alfred Copper and Lead	1	7,500	7,500
Great Crinnis Copper	1	30,000	30,000
Maraquita and New Granada	1	100,000	100,000

	Amount of Share.	No. of Shares.	Capital.
London and Sydney Gold		100,000	
Yuba River Alluvial Gold	£1	100,000	£100,000
STEAM NAVIGATION.			
General Screw Steam Shipping Company			700,000
Australian Royal Mail Steam Navigation Company	10	50,000	500,000
Australian and Pacific Mail Steam-packet Company	20	12,500	250,000
London and New York Screw Steam-ship Co.	10	50,000	500,000
General Iron Screw Collier Co.	5	50,000	250,000
General Screw Collier Co.	10	20,000	200,000
National Patent Steam-fuel Co.	1	50,000	50,000
MISCELLANEOUS.			
Patent and Inventions Company	5	200,000	1,000,000
Continental Timber Preserving	2	25,000	50,000
Crystal Palace	5	100,000	500,000
Ebro Canalization	£21 6*s.* 8*d.*	60,000	1,280,000
Improved Wheel Manufacturing	5	5,000	25,000
Patent Cooperage Company	1	150,000	150,000
Irish Land	25	20,000	500,000
Farmers' Estate (Ireland)	20	25,000	500,000
West of Ireland Land Investment and Beet-sugar, Flax and Chicory	10	50,000	500,000
Irish Beet-sugar	20	25,000	50,000
Sewage Guano	1	50,000	500,000
Plate-glass Insurance			10,000
London, Necropolis, and National Mausoleum			
Extramural Cemetery Association	10	10,000	100,000
Australian and General Emigration	1	100,000	100,000
Australasian Emigrants' Monetary Aid	1	100,000	100,000

LONG'S PATENT VICE, &c.

At p. 172, vol. 1851, we gave a description, accompanied by a plate, of Long's Patent Steering Apparatus, the peculiarity of which consists in multiplying the power of the man at the wheel, by means of a spiral scroll, giving motion to a series of teeth on the rudder head, such teeth being made of the roller form, so as to remove the friction. The same principle has now been further applied, as shown in the annexed engravings.

Fig. 1.



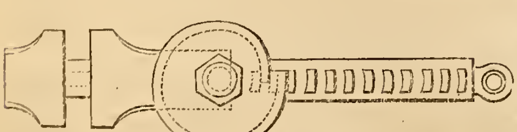


Fig. 2.

Fig. 1. is an elevation, and fig. 2 a plan of a vice, in which the moveable jaw is worked by means of a spanner on the boss of the scroll wheel. In the plan, the spanner is supposed to be removed. The peculiar advantages of this plan are, that the jaws are kept parallel, and that the handle is out of the workman's way. The same plan has also been applied to form a crab, which is very powerful, has little friction, and requires no ratchets. Specimens of these were exhibited by Mr. M'Connell, C.E., at the late meeting of the Institution of Mechanical Engineers, at Birmingham, where they were generally approved of. Figs. 3 and 4 are another example of its application to blind pulleys. After this, we trust to be never again tormented with the clumsy blind pulley in ordinary use.

Fig. 3.

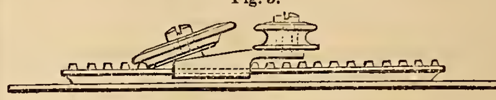
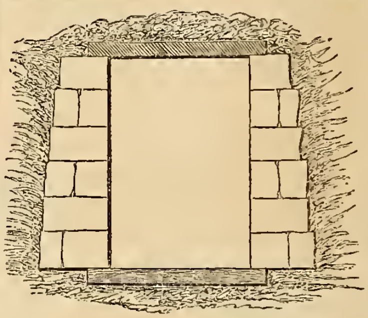


Fig. 4.

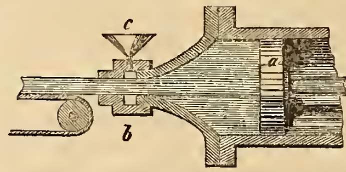
CONSTRUCTION OF SEWERS IN NORWAY.

Lieutenant Klingenberg, of the Norwegian Royal Engineers, who has been recently engaged in reporting on the sewerage and water supply of various towns in Norway, informs us that the usual method, hitherto, of constructing their sewers, has been to lay slabs of timber as a foundation, with sides of dry rubble work, and covered in with stone slabs, as shown in section. The timber being always wet does not decay, as might be supposed, whilst the stone work being laid dry, the sewer takes off the natural drainage of the ground. The surface drainage is carried down by gulleys at the sides of the road, and access is obtained to the sewers by cylindrical shafts, two or three feet in diameter, with stone curbs and iron covers. Wooden covers were formerly used, but they have sometimes been the cause of accidents, by giving way.



The severity of the climate makes the question of water supply, effluvia traps with water seals, and water closets, rather a peculiar one. Water is generally to be had in great abundance and of the purest quality, but its delivery cannot be depended on in winter, unless it is kept constantly flowing through the pipes, and they are well protected by being buried some feet in the earth.

Improved Brick-Die.—Messrs. Fowler and Fry, of Bristol, have recently registered an improved brick-die, designed to prevent the tearing of the clay as it issues from the die. The friction around the sides prevents the clay issuing as fast as it does in the centre, and consequently the work is spoilt. This is prevented by keeping a ring of water round the clay as it issues out, as shown in the accompanying engraving. *a* is the piston forcing the clay; *b*, the ring for containing the water; *c*, a funnel for supplying the water. The clay is thus continually lubricated by the water and prevented from tearing. There is an old story, that a contractor once made a fortune on a heavy contract of clay-cutting, by giving the men buckets of water to dip their shovels into, and thus diminishing their labour.



ROBERTS' PATENT HOLLOW BRICKS.

These bricks, which are well known as having been used in the cottages erected by Prince Albert, in Hyde Park, are gradually coming into general use, although the necessity of making them by machine,

and the payment of royalty, tend to retard their introduction. Mr. Roberts has been fortunate in securing a very extensive patent, which covers any form that will secure "a longitudinal bond, whether obtained by the overlapping of the alternate, or the parallel courses of bricks, either with a square, a rebated, or a chamfered joint, and with a

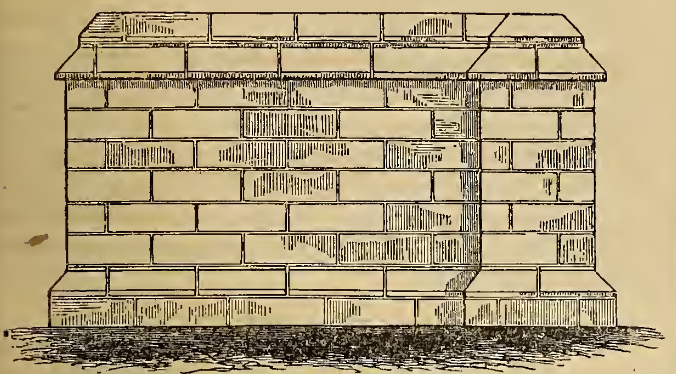


Fig. 1.

level, a sunk, or a bevilled bed." Fig. 1 is a side elevation of a dwarf wall, of which fig. 2 is a section. Fig. 3 shows two different sizes of square rebated bricks (intead of splayed or chamfered joints) which are proposed for cases where extra strength is required.

Fig. 2.

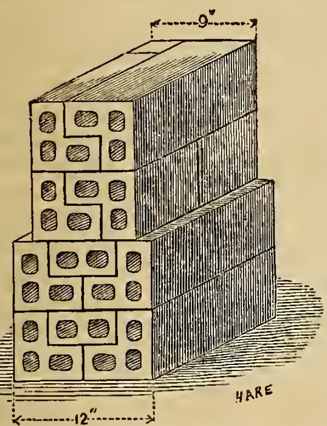


Fig. 3.

The peculiar advantages of these bricks are, that they form a perfect bond, and that all headers and vertical joints being avoided, no damp can be transmitted through these joints. They are also much lighter than the solid brick; stronger, from being equally burnt, and do not transmit sound or heat. They can be made of any dimensions, but are preferred 12 inches in length, and the three courses rising one foot in height. This, with the omission of headers, reduces the number of joints one-third.

With these dimensions the cost per thousand is said to be only one-fourth more than that of ordinary bricks, which, taking the size into account, effects a saving of nearly 30 per cent., with a reduction of 25 per cent. in the quantity of mortar, and the labour, if laid by workmen accustomed to them. Owing to the diminution of weight, a saving will also be effected in the carriage. When used for cottages, the expense of plastering may be saved.

NOTES FROM CORRESPONDENCE.

** We cannot insert communications from anonymous correspondents.

"W. H.," Plymouth, and "Subscriber," Halifax, have not complied with our invariable rule as above.

"B.," Northfleet, too late for this No.

Worthington and Bakers' Steam Pump.—In describing the slide, p. 121, we omitted to mention that *the* reason for its peculiar conformation was that an ordinary slide would not admit the steam in a right direction; the motion of the slide being reverse to that of the piston.

"C. S." Our contemporary, *L'Industrie*, has hit upon the same idea. Sheet iron as thin as paper would be a very bad material in a tropical climate; white ink can be made just as easily as red or blue.

"Air-bubble," is wrong. The compressed air engine is fully dissected at p. 68, vol. 1846. Our opinion of it is unaltered. Our contemporary says the trial was "very imposing." We have no doubt of it, he is very frequently imposed upon.

"B. F." The practice is not yet determined, and can hardly be, until the New Patent law has come into operation. We cannot venture to advise him on such meagre data, but if he will call at our office, he can obtain the information he requires gratuitously.

"R. N." The *Humboldt* is not so fast as the other boats, but she did very well this last voyage, fine weather and fair winds contributed, but the *Great Britain's* run was excellent, nevertheless. We will forward anything to Sweden that he wishes to send.

"A Subscriber," N. York. The fault rests with his bookseller. Our publisher will send *The Artizan* by post, if paid for in advance.

Ericsson's caloric engine is described in August No. 1851.

Books Received.—Weale's "Engineers' Pocket-book for 1852-3;" "Elementary Practical Geometry;" "The Bookselling System," by a Retail Bookseller. Various Newspapers, for which the senders have our best thanks.

LIST OF ENGLISH PATENTS,

From 21st of May, to 24th June, 1852.

Six months allowed for enrolment, unless otherwise expressed.

William Watt, of Glasgow, Lanark, North Britain, manufacturing chemist, for improvements in the treatment and preparation of flax or other fibrous substances, and the application of some of the products to certain purposes. May 22.

David Dick, of Paisley, Renfrew, North Britain, machine-maker, for improvements in the manufacture and treatment or finishing of textile fabrics and materials. May 22.

Richard Roberts, of Manchester, engineer, for certain improvements in and applicable to boats, ships, and other vessels. May 22.

John Harcourt Brown, of Aberdeen, Scotland, and John Macintosh, of the same place, for improvements in the manufacture of paper and articles of paper. May 22.

Louis Victor Ruzé, manufacturer, of Gaillon, France, for certain improvements in the manufacture of hat-plush and other similar silk cloths. May 22.

John James Russell, of Wednesbury, Stafford, patent tube manufacturer, for improvements in coating metal tubes. May 22.

Edward Thomas Bainbridge, of St. Paul's Churchyard, for improvements in obtaining power when fluids are used. May 22.

Samuel Cunliffe Lister, of Manningham, near Bradford, York, machine wool-comber, for improvements in treating and preparing, before being spun, wool, cotton, and other fibrous materials. May 22.

John Swarbrick, of Blackburn, Lancaster, fire-brick manufacturer, for certain improvements in the method of manufacturing retorts used for gas and other purposes, and in the apparatus connected therewith. May 22.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for certain improvements in winnowing machines. (Being a communication.) May 22.

Thomas Knott Parker, of London-wall, Middlesex, carpenter, for improvements in window sashes. May 22.

Johann Stierba, of the firm of Messrs. Eisbrick and Co., of Prague, Bohemia, gentleman, for improvements in furnaces, and in heating and utilising certain products of combustion. May 22.

John Mason, of Rochdale, Lancaster, machine-maker, and George Collier, of Halifax, York, manager, for certain improvements in preparing, spinning, twisting, doubling, and weaving cotton, wool, and other fibrous materials; also in tools or apparatus for constructing parts of machinery used in such manufactures. May 22.

Joseph Walker, jun., of Wolverhampton, Stafford, merchant, for certain improvements in vacuum pans for the evaporation and crystallisation of saccharine or other solutions. (Being a communication.) May 25.

Henry Webster, of Manthorpe, Lincoln, wheelwright, for improvements in regulating the draft in chimneys or flues. May 25.

Adolphus Charles Von Herz, of Cecil-street, Middlesex, Esq., for improvements in treating, preparing, and preserving roots and plants, in extracting saccharine and other juices from roots and plants, in the treatment of such juices, and in the processes, machinery, and apparatus employed therein. May 29.

Frederick Miller, of Fenchurch-street, London, gentleman, for improvements in apparatus for hatching eggs. May 29.

Joseph Lees, the younger, of Manchester, calico printer, for an improved system of preparing, cutting, and engraving rollers to be used for printing woven and other fabrics, and improved machinery for printing and washing the same fabrics. May 29.

Alexander Bain, of Beevor Lodge, Hammersmith, gentleman, for improvements in electric telegraphs and in electric clocks and time-keepers, and in apparatus connected therewith. May 29.

William Septimus Losh, of Wreay Sykes, near Carlisle, gentleman, for improvements in the purification of coal gas. May 29.

Richard Ford Sturges, of Birmingham, manufacturer, for certain new or improved ornamental fabrics. May 29.

William Armand Gilbee, of South-street, Finsbury, Middlesex, for certain improvements in machinery for cutting corks. June 1.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for propelling vessels, and in apparatus to be used in connection therewith. (Being a communication.) June 1.

William Henry Phillips, of Camberwell New-road, Surrey, engineer, for improvements in decorative illumination, and in applying light for other purposes. June 1.

Thomas Willis, of Manchester, machine maker, for certain improvements in machinery or apparatus for winding yarns or threads, and also improvements in looms for weaving. June 1.

Samuel Morris, of Stockport, for certain improvements in steam-boilers. June 3.

William Haughton, of Manchester, for improvements in machinery for spinning cotton and other fibrous substances. June 5.

Robert Hardman, of Bolton, for improvements in looms for weaving. June 5.

Laurent Machabee, of Avignon, for an improved composition applicable to the coating of wood, metals, and other substances to be preserved from decay. June 8.

Edme Augustin Chameroy, of Paris, manufacturer, for certain improvements in steam-engines. June 8.
Enoch Townend, of Keighley, for certain improvements in the manufacture of textile fabrics. June 8.
William Gratrix, of Salford, for certain improvements in the production of designs upon cotton and other fabrics. June 8.
William Rettie, of Aberdeen, for certain improvements in lamps and burners, in apparatus for ventilating apartments, and in the mode of working signal lamps. June 8.
Henry Houldsworth, of Manchester, for improvements in embroidering machines, and in apparatus in connection therewith. June 10.
Thomas Wilks Lord, of Leeds, for improvements in machinery for spinning, preparing, and heckling of flax, tow, hemp, cotton, and other fibrous substances, and for the lubrication of the same and other machinery. June 10.
William Beasley, of Kingswinford, for certain improvements in the manufacture of metal tubes and solid forms, and in apparatus and machinery to be employed therein. June 10.
Michael Joseph John Donlan, of Rugely, Staffordshire, for improvements in treating the seeds of flax and hemp, and also in the treatment and preparation of flax and hemp for dressing. June 10.
Edwyn John Jeffery Dixon, of the Royal Slate Quarries, Bangor, and Arthur John Dodson, of the city of Bangor, gentleman, for improvements in machinery and apparatus used in quarrying slate and stone; and in cutting, dressing, planing, framing, and otherwise working and treating slate and stone, and in apparatus and waggons used for moving and conveying slate and stone, and improvements in joining, framing, and connecting slate and stone. June 12.
William Reid, of University-street, electric-telegraph engineer, and Thomas Watkins Benjamin Brett, of Hanover-square, gentleman, for improvements in electric telegraphs. June 12.
Jean Ernest Beauvalet, gentleman, of Paris, for improvements in the manufacture of iron and steel. (Being a communication.) June 12.
Joseph Brandeis, of Great Tower-street, Middlesex, for improvements in the manufacture of raw and refined sugar. June 12.
George Pate Cooper, of Suffolk-street, Pall-mall East, tailor, for certain improvements in fastenings for garments. June 12.
Thomas Restell, of Kennington, Surrey, watch manufacturer, for certain improvements in the construction of lamps and burners. June 17.
James Norton, of Ludgate-hill, merchant, for improvements in apparatus for ascertaining and registering the mileage run by public vehicles during a given period; also the number of persons who have entered in, or upon, or are travelling in public vehicles; part of which improvements is applicable to public buildings and other places where tolls are taken. June 17.
William Cardwell M'Bride, of Alistragh, Armagh, farmer, for certain improvements in machinery for scutching or otherwise preparing flax and other like fibrous materials. June 18.
Richard Archibald Brooman, London, for improvements in the manufacture of wheels, tyres, and hoops. (Being a communication.) June 18.
William Edward Newton, of Chancery-lane, civil engineer, for improvements in the construction of fences. (A communication.) June 19.
William Burgess, of Newgate-street, gutta-percha merchant, for improvements in the manufacture of gutta-percha tubing. June 21.
Jean Baptiste Georges Landes, of Paris, civil engineer, for certain improvements in locomotive engines, part of which improvements are also applicable to other engines. June 24.
Claude Arnoux, of Paris, gentleman, for certain improvements in the construction of railway carriages. June 24.
Alexander Johnston Warden, of Dundee, manufacturer, for improvements in the manufacture of certain descriptions of carpets. June 24.
James Higgin, of Manchester, manufacturing chemist, for certain improvements in bleaching and scouring woven and textile fabrics and yarns. June 24.
Joseph Swan, of Glasgow, North Britain, engineer, for improvements in the production of figured surfaces, and in printing, and in the machinery or apparatus used therein. June 24.
George Pearson Renshaw, of the Park, Nottingham, civil engineer, for improvements in cutting and shaping. June 24.
James Edward M'Connell, of Wolverton, Bucks, civil engineer, for improvements in steam-engines, in boilers, and other vessels for containing fluids, in railways, and in materials and apparatus employed therein or connected therewith. June 24.
Joseph Hart Mortimer, of Hill-street, Peckham, for improvements in lamps. June 24.

LIST OF SCOTCH PATENTS,

From 22nd of April to the 19th of May, 1852.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the method of, and apparatus for indicating and regulating the heat and the height and supply of water in steam boilers, which said improvements are applicable to other purposes, such as indicating and regulating the heat of buildings, furnaces, stoves, fire-places, kilns, and ovens, and indicating the height, and regulating the supply of water in other boilers and vessels. (Communication.) April 23.
Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of lenses. (Communication.) April 26.
Matthew Urlwin Sears, of Burton-crescent, St. Pancras, Middlesex, commission agent, for the improved construction of guns and cannons and manufacture of cartridges for the boring and charging thereof. April 26.
Thomas Bell, of Don Alkali Works, South Shields, for improvements in the manufacture of sulphuric acid. April 28.
Stewart M'Glashen, of Edinburgh, Scotland, sculptor, for the application of certain mechanical powers to lifting, removing, and preserving houses, trees, and other bodies. April 28.
Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for preventing the incrustation of steam boilers, which incrustation is also applicable to the preservation of metals and wood. (Communication.) April 28.
Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the method of manufacturing, and in machinery to be used in the manufacture of wood screws, part of which improvements is applicable to the arranging and feeding of pins, and other like articles; and also improvements in assorting screws, pins, and other articles of various sizes. (Communication.) April 30.
George Frederick Muntz, jun., of Birmingham, for improvements in the manufacture of metal tubes. May 3.
William Gillespie, of Torbane Hill, Linlithgow, Scotland, gentleman, for an improved apparatus, instrument, or means for ascertaining or setting off the slope or level of drains, banks, inclines, or works of any description, whether natural or artificial, or under land or water. May 5.
William Thomas, of Exe Island, Devonshire, engineer, for certain improvements in the construction of apparatus and machinery for economising fuel in the generation of steam, and in machinery for propelling on land or water. May 5.
Julian Bernard, of Guildford-street, Russell-square, Middlesex, gentleman, for improvements in the manufacture of leather or dressed skins, of materials to be used in lieu thereof, of boots and shoes, and in materials, machinery, and apparatus connected with, or to be employed in such manufacture. May 10.
John Campbell, of Bowfield, Renfrew, North Britain, bleacher, for improvements in the manufacture and treatment or finishing of textile fabrics and materials, and in the machinery or apparatus used therein. May 10.
Richard Christopher Mansell, Ashford, Kent, for improvements in the construction of railways, in railway rolling stock, and in the machinery for manufacturing the same. May 10.
George Leopold Ludwig Kufahl, of Christopher-street, Finsbury-square, London, engineer, for improvements in fire-arms. May 11.
David Dick, of Paisley, Renfrew, North Britain, machine maker, for improvements in the manufacture and treatment or finishing of textile fabrics and materials. May 11.
Charles Ewing, of Bodorgan, Anglesea, steward and gardener, for an improved method or methods of construction, applicable to architectural and horticultural purposes. May 11.
Anthony Granara, of Leicester-place, Leicester-square, Middlesex, hotel keeper, for an improved apparatus for lubricating machinery. May 14. Four months.
Clemence Augustus Kurtz, of Manchester, Lancaster, manufacturing chemist, for an improvement in all preparations, of every description, of madder roots and ground madder, in and from whatever country the same are produced; also in munjeet, in the root and stem from whatever country. May 17.
William Watt, of Glasgow, Lanark, North Britain, manufacturing chemist, for improvements in the treatment and preparation of flax or other fibrous substances. May 17.
Peter Fairbairn, of Leeds, York, machinist, and Peter Swires Horsman, of Leeds aforesaid, flax-spinner, for certain improvements in the process of preparing flax and hemp for the purposes of heckling; and also machinery for heckling flax, hemp, china grass, and other vegetable fibrous substances. May 17.
William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the manufacture of coke, and in the application of the gaseous products arising therefrom to useful purposes. May 19.

LIST OF IRISH PATENTS,

From 3rd of May to the 17th of May, 1852.

Joseph Pimlott Oates, of Lichfield, Stafford, surgeon, for certain improvements in machinery for manufacturing bricks, tiles, quarries, drain pipes, and such other articles as are or may be made of clay or other plastic substances. May 4.
George Torr, of the chemical works, Frimley-lane, Rotherhithe, animal charcoal burner, for improvements in the burning animal charcoal. May 17.
James Pillans Wilson, and George Fergusson Wilson, both of Wandsworth, Surrey, gentlemen, for improvements in the preparation of wool, for the manufacture of woollen and other fabrics, and in the process of obtaining materials to be used for that purpose. (Being partly a communication.) May 17.

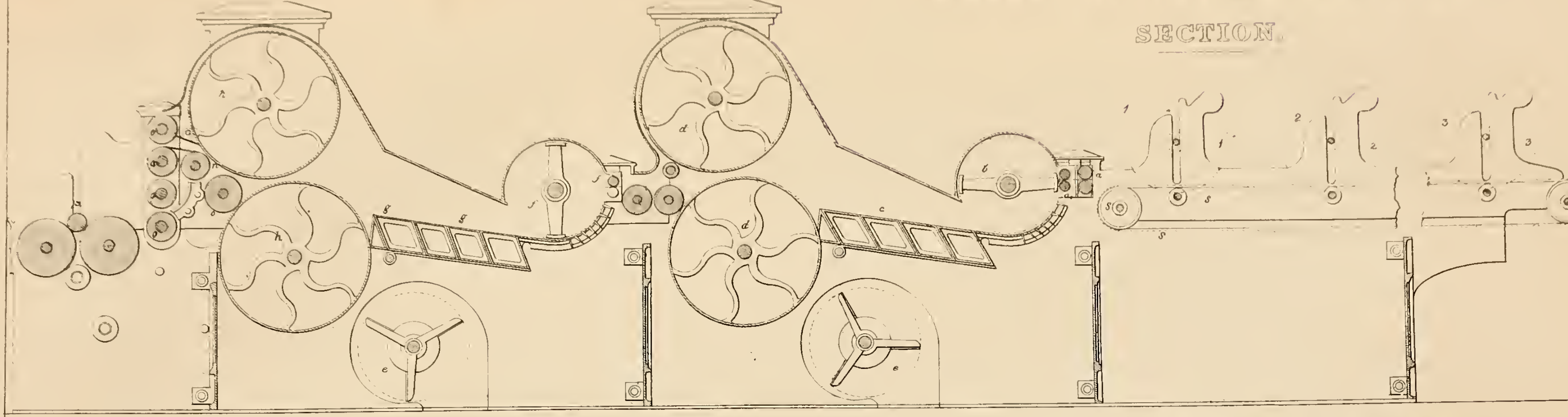
DESIGNS FOR ARTICLES OF UTILITY,

From 20th of May to the 23rd of June, 1852.

May 21, 3262, J. Wanthier, Wilmington-square, "Portable and house barometer."
„ 21, 3263, W. C. Cambridge, Bristol, "Straw shaker."
„ 22, 3264, R. Mallet, Dublin, "Iron plate for roofs."
„ 22, 3265, C. Lenny, Croydon, "Carriage-wheel plate."
„ 24, 3266, A. J. Schatt, St. James's, "Royal Cambridge valve bugle."
„ 25, 3267, R. W. Winfield, Birmingham, "Spring letter balance."
„ 26, 3268, W. Quinton and Co., Birmingham, "Rule joint."
„ 26, 3269, W. Dray and Co., London-bridge, "Cradle machine for washing and gold detecting."
„ 26, 3270, G. Harriott, North Walsham, "Screw clod crusher."
„ 27, 3271, C. Richards, Birmingham, "Core peg for Minié rifle-bullet moulds."
„ 28, 3272, W. Welby, Bermondsey, "Life buoy."
„ 28, 3273, T. F. Griffiths, Birmingham, "Letter-box."
„ 28, 3274, J. Tuke, Doncaster, "Water-closet."
June 1, 3275, Henry Maling, Home-office, "Form of rifling for fire-arms."
„ 1, 3276, L. Stubbs and T. Fleming, Birmingham, "Nail or screw."
„ 1, 3277, Robert Adams, King William-street, "Balls or projectiles."
„ 2, 3278, F. Brampton, Birmingham, "Music folio or leaf-holder."
„ 2, 3279, Wagstaff and Co., Mark-lane, "Portable candle-lamp."
„ 3, 3280, T. A. Readwin, Winchester-buildings, "Self-acting curry comb."
„ 3, 3281, E. Windsor, Lille, France, "Gill-machinery."
„ 4, 3282, P. Lawson and Son, Edinburgh, "Box-edging cutter."
„ 4, 3283, J. J. Ball, Wenlock-road, City-road, Master R.N., "Disengaging apparatus for lowering boats from ships' sides at sea."
„ 5, 3284, J. Barnett, Birmingham, "Apparatus for heating water."
„ 5, 3285, T. Bland, Birmingham, "Cover for vessels."
„ 5, 3286, W. Smith, Bucks, "Subsoil plough and stirrer."
„ 7, 3287, W. Dray and Co., Swan-lane, Upper Thames-street, "Chaff and litter-cutting machine combined."
„ 7, 3288, J. Tucker, Charlton, Kent, and J. E. Saunders, Gracechurch-street, "Inflated water-proof tent."
„ 7, 3289, W. Bridson, Liverpool, "Plate and dish warmer and meat-cooler."
„ 8, 3290, T. F. Griffiths, Birmingham. "Gold-washing and detecting machine."
„ 9, 3291, J. J. Ball, Wenlock-road, City-road, "Disengaging apparatus for lowering boats."
„ 10, 3292, J. Cooper, Towerhead, near Somerset, "Compound geometric and spiral chuck for a lathe."
„ 10, 3293, E. Bull, Halifax, "High-pressure valve or stop-cock, for gas, water, or other fluids."
„ 10, 3294, T. and C. Clark and Co., Wolverhampton, "Apparatus for frying and boiling at the same time."
„ 10, 3295, R. Lancaster, Bolton-le-Moors, "Miners' safety-lamp."
„ 10, 3296, M. A. Biggs and A. P. Collins, Berkley-street, Clerkenwell, "Letter-spring."
„ 10, 3297, M. A. Biggs and A. P. Collins, Berkley-street, Clerkenwell, "Card-case."
„ 11, 3298, J. T. Champion, Exeter, "Mould for casting hollow or Minie rifle-bullets."
„ 11, 3299, A. Jackson, Orpington, Kent, "Tray and apparatus for a tea or coffee-pot and cups."
„ 14, 3300, Parker, Field, and Son, High Holborn, "Spring-ramrod to be attached to, for the purpose of loading single-barrel revolving-chambered pistols."
„ 14, 3301, C. W. Lancaster, New Bond-street, "Gun-ball patch."
„ 15, 3302, J. Mather, Newcastle-on-Tyne, "Bread and pastry oven."
„ 15, 3303, Lennox and Jones, Billiter-square, "Anchor."
„ 16, 3304, T. Reid, Monkton, Ayrshire, "Combined double mould-board plough, seed-sower, and manure sowing-rutter."
„ 17, 3305, H. Thomas, Birmingham, "Pickaxe."
„ 17, 3306, H. Thomas, Birmingham, "Pickaxe."
„ 18, 3307, Hodges, Brothers, Noble-street, "Vest-front."
„ 19, 3308, A. Suter, Fenchurch-street, "Ventilating wind-guard."
„ 20, 3309, S. Rooke, Birmingham, "Tubular oilcloth-cover for cornice-poles."
„ 22, 3310, J. Southgate, Watling-street, "Portmanteau."
„ 23, 3311, J. Southgate, Watling-street, "Expanding portmanteau."

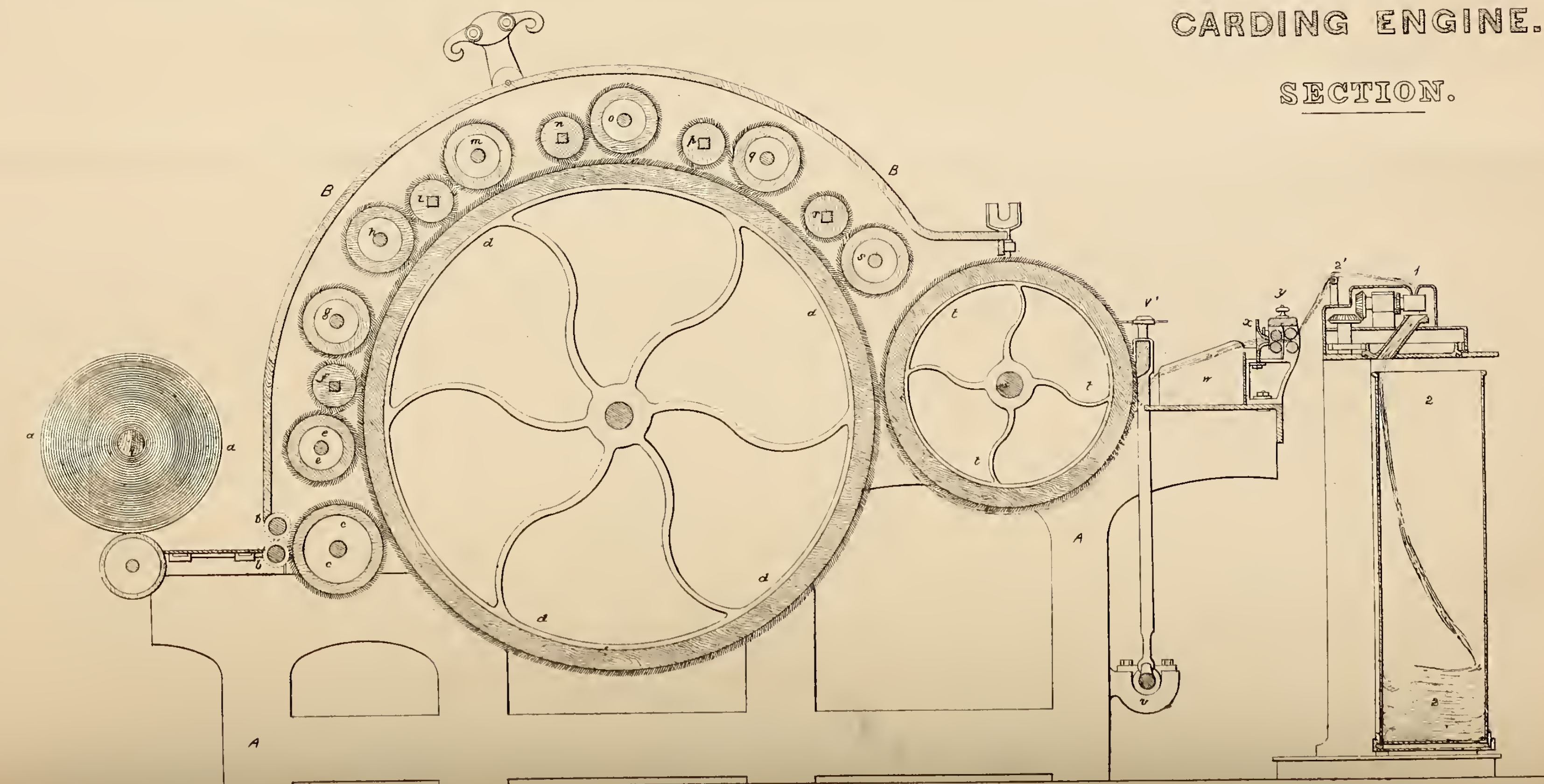
DOUBLE BEATER LAP MACHINE.

SECTION.

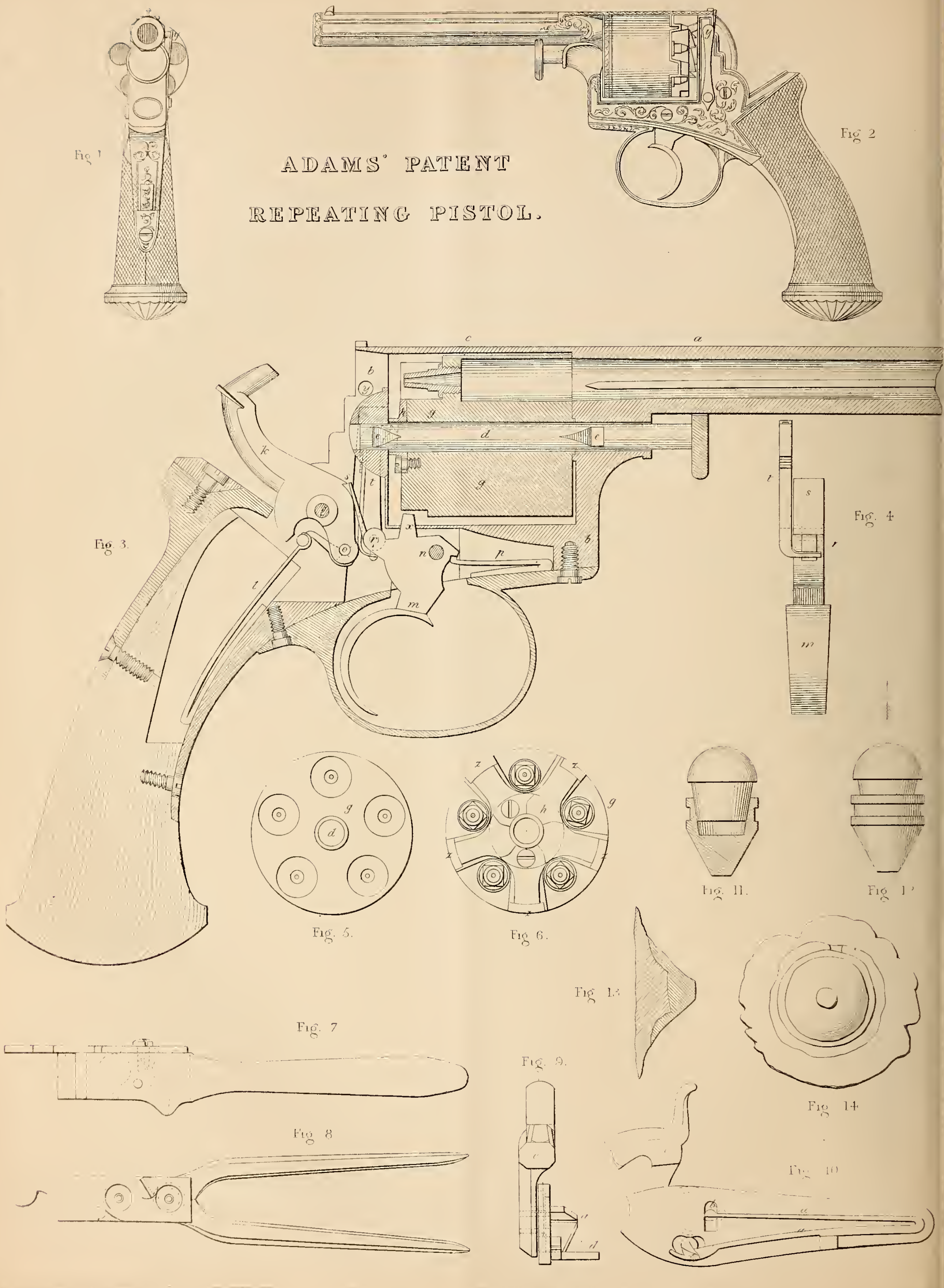


CARDING ENGINE.

SECTION.



ADAMS' PATENT REPEATING PISTOL.



THE ARTIZAN.

No. VIII.—Vol. X.—AUGUST 1st, 1852.

THE EVENTS OF THE MONTH.

It is usually understood to be an admitted principle, that when a railway company undertakes to convey passengers, they are bound to use every known means which will conduce to their safety. It follows, therefore, if an accident occurs, with loss of life, which it can be shown would have been prevented by the use of any machinery in which the railway is deficient, that the responsible persons—the directors—are guilty of manslaughter, inasmuch as they have neglected to take all the precautions which they were bound to do. A number of railway accidents have recently taken place, in which the want of any adequate control over trains in motion has been the cause of death and severe injury to the passengers. Our readers will ask, whether any practical plan for effecting this object has ever been suggested to the directors of these railways, or whether they have ever sought for any such plan? We reply, that not only have such plans been suggested and tried, but they have been uniformly set aside; in one instance, as we are credibly informed, because the engineer of the line expressed his opinion that such a plan would tend to render the engine-drivers careless.

Let us see how these things happen. Here is an "official report" (as it is called in the *Times*, which means, we suppose, one supplied by the company's officers) of an accident on the South-Eastern line:—"The down pick-up train arrived at Headcorn, and was shunted on to the up-line of rails, in the usual manner, to allow the mail to pass, *the danger signals being exhibited*, and proper precautions taken to stop all trains on the up-line. While the pick-up train was thus waiting on the up-line, the Paris tidal train from Folkstone came on at its ordinary speed, the *driver either not seeing, or disregarding the signals*, until within too short a distance to prevent a collision with the stationary train, into which it ran with such force, as to knock two of the empty trucks over on to the down-line, just in front of the mail train, which came by at the moment, thus causing a second collision." This means, in plain English, that when a train full of passengers is standing at a station, and another train is meeting it, there are no means of stopping that approaching train except by exhibiting a signal, which the engine-driver may or may not see, and may or may not pay attention to. It is monstrous to call this protecting the lives of the passengers. The remedy wanted, as we have more than once explained, is an appliance for shutting the steam off an engine at such a distance from the station, that the heaviest train will be brought up in time to prevent a collision; and this mechanism must be at the command of the station-master, so that, by merely turning a handle, he can stop a train 300 or 400 yards off. Anything short of this is a mere evasion of the difficulty; and until such a system be adopted, railway directors and railway engineers cannot honestly say that they are guiltless of the blood of their fellow-creatures.

The proposition of the Eastern Steam Navigation Company, published at length in another place, has excited considerable attention, from the boldness of the project. That a greater speed is to be obtained by a given proportion of power to tonnage with large vessels, than with small ones, is an established fact; but we have no data, except perhaps from some of the largest American river steamers, which combine high speed with large tonnage. The dimensions mentioned for the Eastern Company's steamers are 600 feet long and 60 feet beam. The only figures we can compare with this are those of the *Great Britain*, which is 289 feet keel and 51 feet beam, or $5\frac{3}{5}$ beams in length; and those of the Britannia tube, which is 472 feet long. A difficulty, which will probably be felt with such large vessels, is their draft, which will prevent their taking advantage of many harbours which it would be desirable for them to enter; but into this question, as well as that of their propulsion, it is premature to enter, until we have something more definite from the engineering advisers of the company. We think that too much stress has been laid upon the advantage of carrying coals for the whole voyage; and, as it is a question of figures, we will endeavour to supply the data. Supposing that 2,000 tons of coal are required for the whole voyage, at 15*s.* per ton, in England, that gives £1,500. But if half the coal were taken in in England, and the other half at the Cape, at £2 per ton, we have 1,000 tons at 15*s.*, and 1,000 at £2, or total, £2,750 for the voyage out. Add to both these sums £4,000, for the voyage home, we have £5,500 on the one side, and £6,750 for the the other, showing a saving of £1,250, or less than £20 per cent. But in reality, if coals could be got for nothing in England, it would pay better to carry goods at £6 per ton than coals at £2. No doubt the stopping at the Cape would entail some delay and the annoyance of coaling; but, on the other hand, it would give another mail port, and the mails *must* go by the fastest boats, to whatever company they belong.

If we are indignant at the indifference of our own railway directors, what must we say to the accounts which reach us every mail of the explosions on board steamboats in the United States? It is enough to make a man's blood run cold to hear even their own account of the way things are managed. The following paragraph from the Madison *Courier* tells its own tale:—"The steamer *Redstone* came in last night with some 80 passengers and a fair freight-list. The *Redstone* is one of the fast ones, as the crack steamer, *Buckeye*, found out yesterday, after lying out in the river to wait for her. The *Redstone* took her on the wing—passed her under weigh easy. Captain Pate is very much elated—thinks of making a fast run from St. Louis to Cincinnati." After this, we need not be surprised at the dying declaration of the assistant-engineer, Ryan. "Himself and Buchanan, first engineer of the boat, were on watch. Some time before reaching port, he (Ryan) tried the water in the boilers, and found it very low, and called to Buchanan, and informed him of the fact, and received some evasive answer. He again tried the water, and again called to Buchanan, who told him to mind his own business; that there was water enough in the boilers. Subsequently, Buchanan remarked that the boat was making good time, and he would take her into St. Louis 'kiting.' This was perhaps the last remark made, and when the boat reached the wharf, and commenced trying to effect a

landing, Buchanan turned on the gauge-cock (feed-cock seems meant), and let on the water. The instant the cold water came in contact with the heated boilers, now nearly dry, the explosion took place."

The law appears not only inefficient, but to be also very badly administered. By later accounts, a petition has been presented to Congress by the engineers of numerous boats, for more stringent regulations.

We may here also mention, that the bill for increasing the subsidy to the Collins steamers has passed the legislature.

AGRICULTURAL ENGINEERING.

EXHIBITION OF THE ROYAL AGRICULTURAL SOCIETY AT LEWES.

Those who charge the agricultural world with apathy, and indifference to improvement, may be readily answered by a reference to the annual exhibition of implements and stock held by the great Agricultural Societies of England, Scotland, and Ireland, as well as those more numerous ones depending on local support. The annual exhibition of the Royal Agricultural Society of England at Lewes, in Sussex, has just been concluded, and we hasten to present our readers with a report of the improvements in the mechanical department, which are neither few nor unimportant.

The portable steam engines occupy the first place, and it is in those that the improvement is the most striking. In noticing those in the Crystal Palace, we censured the gingerbread brass-work which some makers appeared to think indispensable to their engines, and we are glad to say that we discovered signs of some improvement in this direction. A portable engine which has to bear exposure to the weather is the better for the absence of bright work, as it is rarely kept clean, and the emery generally used in profusion to clear off the rust not unfrequently insinuates itself into the bearings, to their manifest detriment. Mr. Tuxford, by putting a vertical engine at the smoke-box end, gets it completely housed. (For engraving, see *Artizan*, 1851, p. 243.) It appears to us that it would be expedient to cover up the cylinder and moving parts, in all portable engines, which might be done at a trifling expense; and would not only keep out rain, dust, &c., but also serve to retain the heat.

Only a few makers have paid especial attention to the latter point, the rest being content with clothing the cylinders. Messrs. Hornsby and Son place the cylinder in the steam-chest, over the furnace, which they state, "effects a great saving of fuel, which is an important consideration in a portable engine; it also does away with condensation in the cylinder, rendering the engine less liable to get out of order, likewise the management less troublesome, having no condensed water in the cylinder. In all engines with the cylinder outside the boiler, the water in the cylinder, pipes, and pump (?) in the winter season frequently becomes frozen; and even if great care is taken by the person in attendance on the engine, injury is often done—and if not, much time is lost. This is an evil which never can take place in the exhibitor's patent engine." Tuxford's we have already noticed. Mr. Batley places the cylinder in the smoke-box.

Messrs. Barrett, Exall, and Andrewes also place the cylinder in the smoke-box, and, in addition, bring the heated air and smoke from the smoke-box, back through a casing surrounding the barrel of the boiler; an arrangement which they have lately patented. This plan, undoubtedly gives a greater heating surface, and also serves to prevent any sparks issuing from the chimney, which on this system rises from near the fire-box end.

The grand point, however, which this "exhibition" has developed, is the extraordinary economy of fuel which has been obtained by the use of expansion gear in the Messrs. Hornsby's engine, and in that of Messrs. Barrett and Co.'s, as shown in the accompanying table of their duty:—

TRIALS OF PORTABLE ENGINES.

Makers.	Horse-power by Dynamometer.	Price.	Fuel for getting up steam.*	Time occupied in getting up steam.	Coal per hour.	Coal per horse-power per hour.	Diameter of cylinder.	Length of stroke.	No. of revolutions per minute.
		£	lbs.	min.	lbs.	lbs.	ins.	ins.	
Hornsby	6	205	30.2	50	28	4·666	7⅜	14	128
	4	165	24·9	47	24·2	6	6½	12	128
Barrett, Exall and Andrewes	6	190	23·5	49	32·68	5·44	8¼	12	120
Clayton, Shuttleworth & Co	6	201	22·76	60	36·036	6·006	8½	12	115
	4	155	29·5	41	33·6	8·4	6	10	130
Garrett and Sons	6	200	19·09	32	42·63	7·105	8½	12	110
	5	180	36	69	49·5	9·9	8	12	100
Ransomes and Sims	6	210	32·6	56	49·9	8·316	7	10	150
Tuxford and Sons	4	165	22·1	52	33·92	8·48	6	10	150
W. Batley	6	150	61·57	47	52·98	8·83	7	14	..
W. C. Cambridge	5	165	19·5	36	73·25	14·65	..	..	..

The power of each engine is tested by a friction-brake forming a dynamometer. The exhibitor states the power the engine is guaranteed to exert, and the number of revolutions per minute it should make, and the dynamometer having been adjusted accordingly, the consumption of Welsh coal is tested for (we believe) three hours. The friction-brake gives the net power exerted by the engine, and therein differs from indicator diagrams, from the results of which a certain allowance has to be made for friction. This simplifies matters, but we think that a little saving of trouble should not be allowed to stand in the way of attaining greater scientific accuracy, which can only be done by separating the duty of the boiler from that of the engine. Thus, the evaporative power of the boiler should first be tested, by boiling off as much water per hour as the engine usually consumes. This would give a measure of the comparative value of large or small tubes, copper or iron fire-boxes, &c. The engine should then be indicated whilst driving the friction-brake, and the difference between the results obtained from the indicator and the brake would give the power absorbed in the friction of the moving parts, whilst the shape of the indicator diagrams would show whether the ports and slide were properly proportioned. The necessity for attending to these points is evident, when it is considered that not only is the goodness of the boiler tested, but likewise the skill of the stoker. On such apparently slight causes do such things turn, that we have seen a material difference in the production of steam between the engine standing to windward or to leeward of the barn.

One point will strike those accustomed to indicate engines, viz., the low power obtained from a given size of cylinder. Thus, take the best engine with $7\frac{3}{8}$-inch cylinder, the net average pressure on the piston throughout the stroke will scarcely exceed 30 lbs., which would be obtained by cutting off 60 lbs. steam at $\frac{1}{2}$; and in the other engines not working so expansively, and having even larger cylinders, the initial pressure of steam must be considerably less. With such small boilers there would appear no danger in using steam at 80 or 100 lbs. on the square inch. Steam engines are usually expected to work up to much more than their nominal power, and the Royal Agricultural Society can boast of being the first to set the example of compelling engine-makers to sell engines by actual horse-power.

In working expansively, there is some advantage in keeping the cylinder hot (as is done in Cornwall with a steam jacket), and this is provided for in the engines we have already mentioned, by placing the cylinders in the boiler or smoke-box.

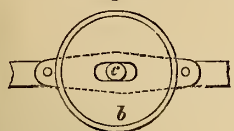
The expansion valves adopted by Messrs. Hornsby and Messrs. Barrett are of the gridiron form, worked by a separate eccentric; a mode which is illustrated, together with Mr. Atherton's patent method

* To each of the above quantities of coal used in getting up steam, must be added 20 lbs. of wood.

of varying the expansion, at p. 228, vol. 1850. In Messrs. Clayton and Shuttleworth's engine, a water bridge is introduced in the furnace, running longitudinally, and not transversely, as usual. Where coal and wood are used, we are not sure whether this space thus abstracted from the fire-box can well be spared.

Amongst the novelties in the details of portable engines, we may mention a very excellent contrivance by Messrs. Ransomes and Sims, which they term a "spherical locking carriage," and which will be readily understood from the accompanying sketch. Fig. 1 is a transverse section of the carriage of a portable engine, and fig. 2 is a plan

Fig. 2.



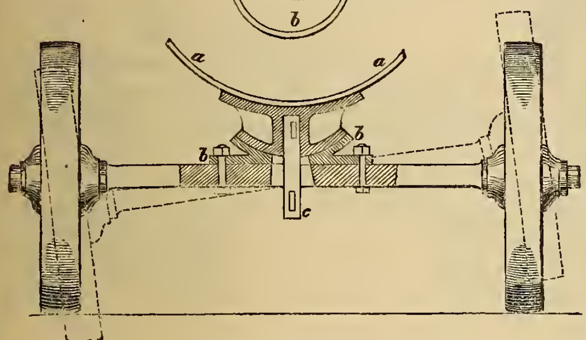


Fig. 1.

of the locking plate. *a a* is the shell of the boiler, to which is bolted a plate having a convex face, which fits a similar concave face, *b*, bolted to the axle, like a ball and socket. A pin, *c*, is keyed into the convex plate, and there is a transverse slot in the lower plate and axle. This arrangement permits the axle to turn in any direction, and at the same time, in going over uneven ground, one wheel may be elevated, and the other depressed, as shown by the dotted lines, without throwing any cross-strain on the axle, and without disturbing the level of the body of the carriage. In the ordinary locking plate, where the faces are flat, the parts have to be made stronger, and there is a great deal of friction, which in the case of a heavy machine adds considerably to the draught.

Messrs. Ransomes and Sims also exhibited a variety of small fixed engines of excellent design and workmanship, consisting of a horizontal engine, in which the cylinder is sunk into the sole plate, which is of the box form, and gives great stability to the engine. Another, of the inverted description, in which the cylinder is supported by four columns of double T section, and the crank shaft is carried on the sole plate below. This arrangement also gives great stability and takes up less room in length than the horizontal engine. They also exhibited a very neat horizontal oscillating engine and corn mill combined. These engines have very neat stop valves, consisting of a small cylinder, faced for part of the circumference inside, on which lies a valve, forming, as it were, a portion of the plug of an ordinary cock, and moved in like manner.

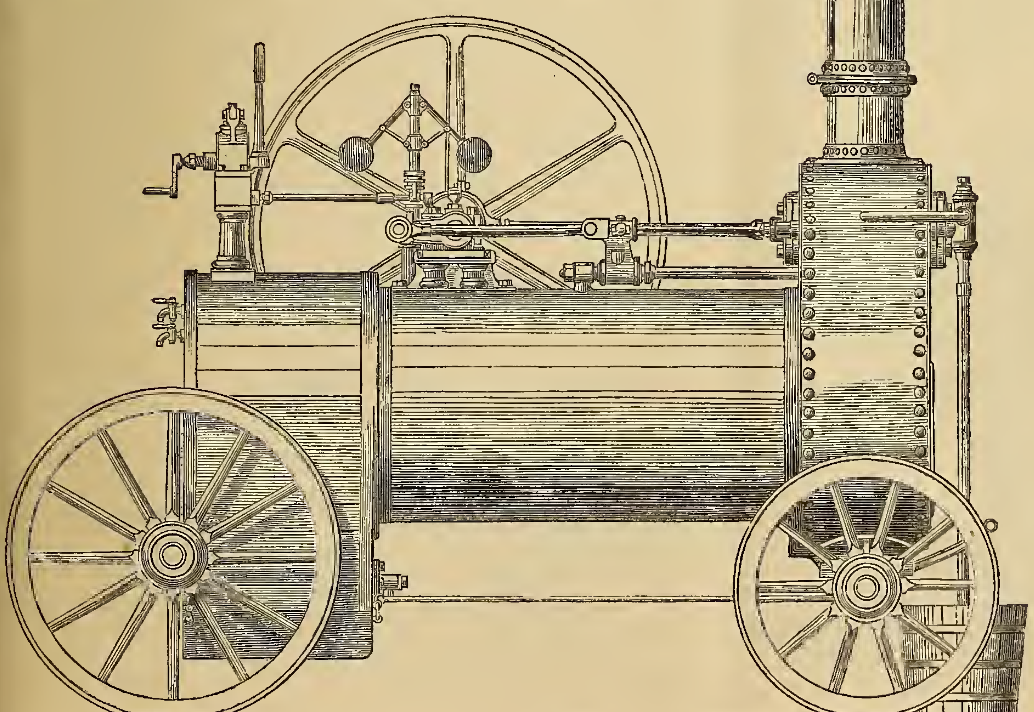


Fig. 3.

Mr. Batley's engine is represented in the accompanying engraving, fig. 3, drawn to half-inch scale. A noticeable peculiarity is the way in which the piston-rod cross-head is guided, the guide consisting of a single stout rod, below the piston rod, the cross-head sliding on it, and being furnished with a stuffing box containing hemp packing. The stop valve is of the gridiron form, the pressure tending to keep it tight, and moved by a lever taking hold of the slide. This engine is constructed in a plain but substantial manner.

Mr. Batley has also favoured us with a sketch of his fixed horizontal engines, shown at fig. 4. The feed pump, it will be seen, is worked off the piston rod cross-head. The slide is worked from a weigh-shaft, and is easily got at. by taking off the slide-chest cover, The exhaust is led through a belt. round, and below the cylinder, The governor is attached to the throttle-valve in the following manner :—A toothed sector is keyed on the prolongation of the throttle-valve spindle, and is moved by a series of rings turned out of the sliding collar on the governor spindle; these rings take into the teeth of the sector, and communicate their motion to the throttle-valve, whilst their form allows the collar to revolve freely.

Messrs. Barrett, Exall, and Andrewes exhibited some good specimens of vertical engines, a modification of that known as Fairbairn's engine. Messrs. Barrett and Co. have, however, used a

column of much larger diameter than usual, for supporting the crank-shaft, and have placed the slide outside. These improvements have the effect of giving more stability to the engine, and of rendering the parts much more accessible than in Mr. Fairbairn's engine. The crank being double, no outer bearing is required, and the fly-wheel is arranged on one side, and the eccentrics on the other. A gridiron expansion valve is applied, and worked by an additional eccentric, as is usually practised.

We must reserve our remarks on some other of the steam engines until our next number.

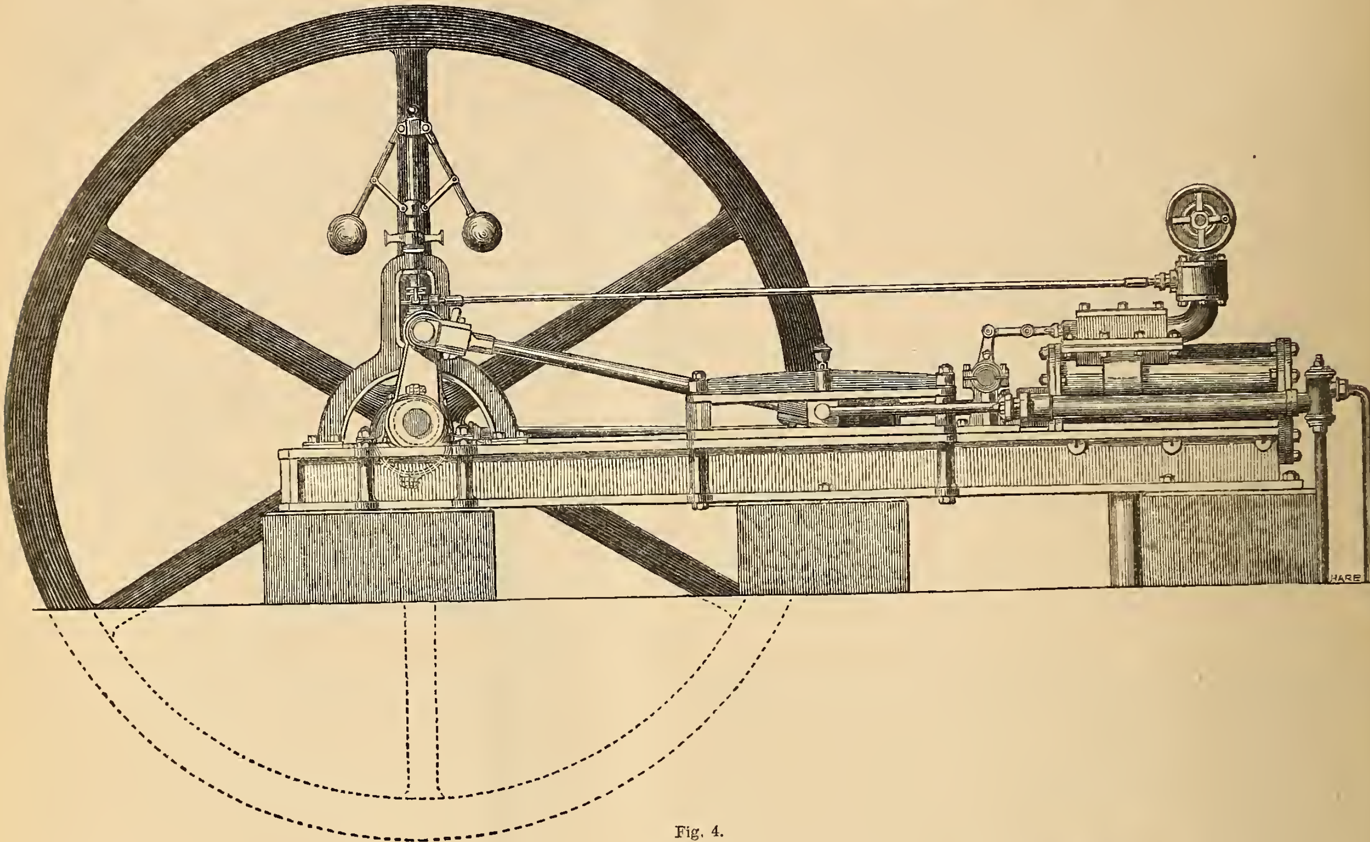


Fig. 4.

Amongst the hydraulic machinery, we have noted a lift for wells, constructed in a very efficient manner, by Messrs. Tasker and Fowle (of the Waterloo Iron Works, near Andover), and represented in fig. 5. It has received the silver medal both at Southampton

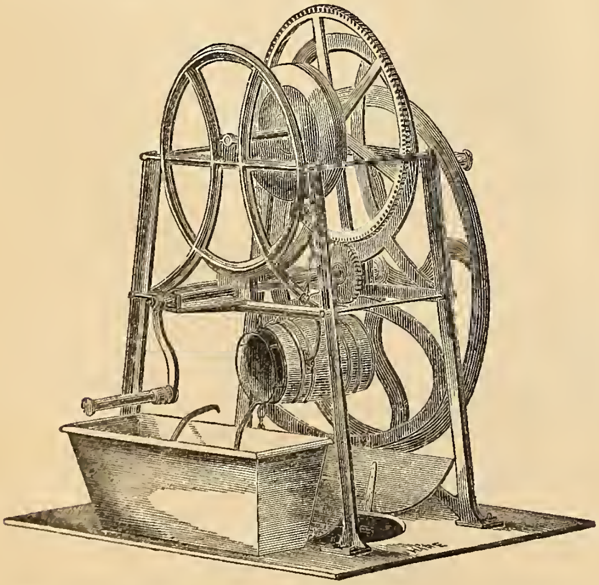


Fig. 5.

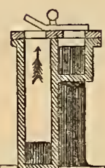


Fig. 7.

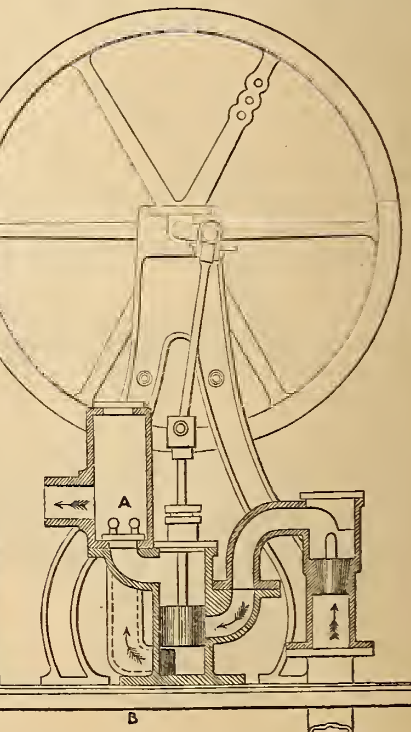


Fig. 6.

and Lewes shows. Two buckets, holding about twelve gallons each, are employed in balance, the chain to which they are attached being passed over a pulley worked by winch-handles, through the intervention of a wheel and pinion. When the full bucket reaches the surface, a ring round the mouth of it is caught by an iron hook, which tilts the bucket over, as shown in the sketch, and empties its contents into the trough, without requiring the men to move from the handles. The hooks are hung on centres in the trough, so that they fall down when the bucket is lowered, and ensure its being caught at the next lift. The apparatus is constructed entirely of iron, and is self-contained, on an iron sole-plate. Those purchasers who can put up a wooden framework themselves, may save the expense of the iron frame-work.

A contrivance, which has been patented some time, but which has only recently been brought before the public, is Urwin's Patent Double-acting Pump, shown at fig. 6, drawn to a scale of $\frac{3}{4}$ inch to a foot. It is of a very peculiar construction, and its power appears to be measured by its keeping the water in motion when once started, rather than by the displacement of the piston, as we are accustomed to calculate ordinary pumps. The plunger, which is a solid packed one, is moved by a hand-wheel and crank. There is only one suction-passage in the *middle* of the barrel, and there are two delivery passages, one at the top and the other at the bottom, the latter being carried up so as to bring both delivery valves on one face, to which they are fastened by thumb-screws, as shown in fig. 7, which is a transverse section across the line A B, supposing the delivery cistern to be removed. The supply rises through a clack-valve, fixed in a syphon-pipe leading to the well. The course of the water is indicated by the arrows. If we suppose the plunger to be going up, it is obvious that a partial vacuum will be formed under it; but the water cannot enter the barrel until the edge of the plunger has passed the suction passage, when it will rush in, and, as far as we can judge, from watching the action of the pump, the momentum of the entering water appears to carry it up the lower delivery passage, before the plunger has commenced its down-stroke. The same action takes place, on the return of the plunger, which forces all the water below it up the delivery passage, whilst the barrel fills at the top. If it were not for the valve in the suction-pipe, it would appear as if a portion of the water below the piston would escape back through the suction-pipe; but, nevertheless, these pumps will throw a large amount of water, as we have witnessed, without any suction-valve. We have not satisfied ourselves as to their duty by critical experiment, but we shall probably have an opportunity of doing so, when we will lay the result before our readers. The advantage claimed is, the power of pumping water containing shavings, or grain, or tar, starch-pulp, &c., which will entirely choke ordinary pumps. The position of the delivery valves affords great facilities for keeping them clear, as they can be got at in an instant. When the pump is designed to act as a fire-engine, an air-vessel is fixed on the top of the delivery cistern, and the hose attached to the nozzle.

The reaping machines came out in full force, a great number being exhibited. Messrs. Garrett and Sons (of Leiston Works, Suffolk), which we have already illustrated (p. 248, vol. 1851), obtained the prize, having, on trial, distanced all competitors. Since we last described it, they have simplified and lightened the wooden frame-work, and enclosed it in a case. They have also altered the shape of the knives, so as to give them a scissors' edge, by which they tend to sharpen themselves, and cut cleaner than before. Provision has also been made for raising and lowering the cutting table, without stopping the machine, which, on uneven ground is an important advantage.

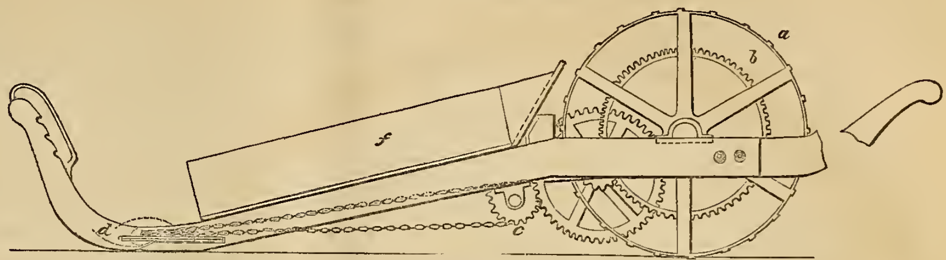


Fig. 8.

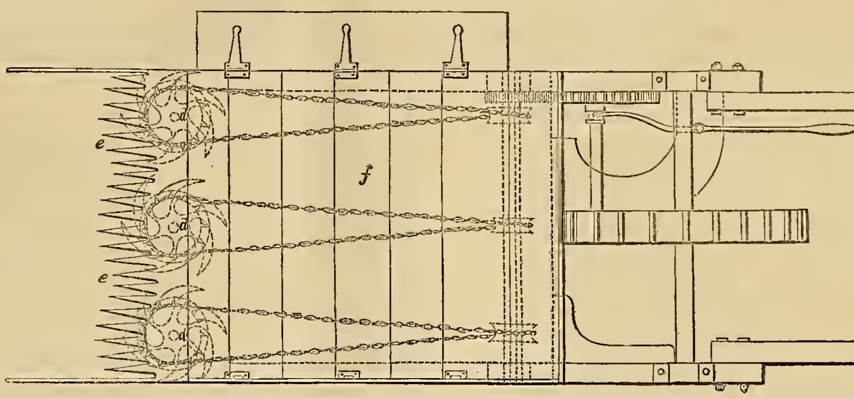


Fig. 9.

The most original idea, however, is Mr. Mason's (of Ipswich), who has boldly adopted the principle of the circular saw. Fig. 8 is an elevation, and fig. 9 a plan, of Mr. Mason's registered reaping machine. It is drawn by horses, in the usual method, and guided like a plough, by a man at the handles, which in the sketch are shown broken off, to save length. *a*, is the large wheel, which takes the weight of the machine, and its motion is communicated by the spur wheels to the pinion, *c*, on the spindle of which are fixed three chain-drums, which, by means of endless chains, give motion to the horizontal circular saws, *d*, *d*, *d*, shown dotted. Under the table of the machine, a comb, *e*, *e*, is provided, to support the wheat-stalk whilst being cut. This machine has only just been invented, and we cannot therefore report on its qualities.

We may commend, as a problem to our ingenious readers, the invention of an arrangement for collecting and binding the sheaves as fast as the wheat is delivered by the machine. It is rather too severe work, at present, for the man on the machine, who has to fork a rake-ful of wheat over the tail of the machine, without cessation or breath-

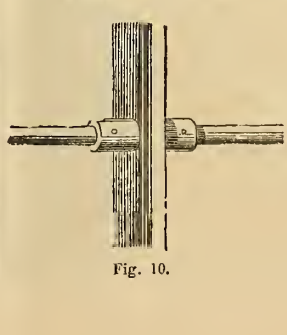


Fig. 10.

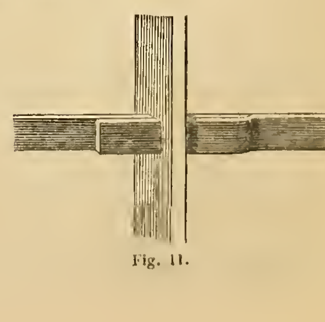


Fig. 11.

ing time; and the effect on ripe wheat is prejudicial, as it tends to shake the grains out of the ears. A "collector" is wanted, and, we hope, will be forthcoming before the season is over.

Messrs. E. Hill and Co. (of Brierly Hill Works, near Dudley) exhibited a large collection of wrought-iron work, such as fencing, hurdles,

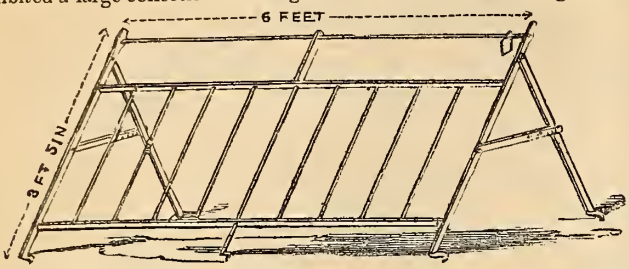


Fig. 12.

gates, rick-stands, &c.; articles, which their position, in the centre of the iron district, enables them to supply on such terms, as to lead to the hope that monstrous hedges, occupying much land, and spoiling more, may give way before them. For a sheep fence, the following sizes and construction are adopted:—Height above ground, 3 feet 4 inches; depth of standards below ground 13 inches, having a double-pronged foot, to give steadiment. The standards are 3 feet apart, with five rails—the top one round, $\frac{5}{8}$ diameter, in 15 feet lengths, and secured at every fifth standard by the socket-joint, fig. 10, which passes through the standard, and is keyed on each side to the rails. The lower bars are all flat, 1 inch by $\frac{1}{4}$ inch, placed on edge, to bear the weight of trespassers. These are also in 15 feet lengths, and connected in the standards by lap-joints, shown in fig. 11, which transmit any thrust, by the butt-end, through the whole line of fence. These joints have the convenience of admitting of one or more pieces being temporarily removed to make a passage.

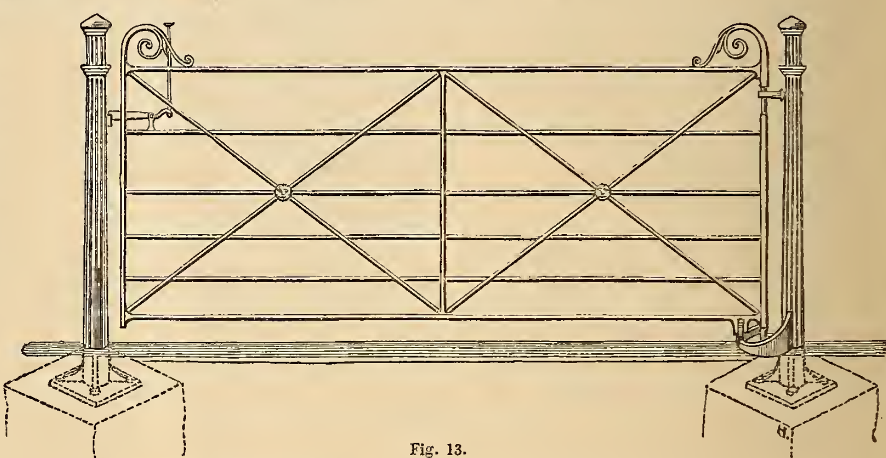


Fig. 13.

The sheep-feeding hurdle, fig. 12, is a simple and effective contrivance for feeding a crop off with sheep, as they are prevented treading on and spoiling what they do not eat, and the hurdles which form a rack for them to eat through are readily shifted in a few minutes by a boy. From their angular position, they stand with great firmness on the softest ground.

Fig. 13 is a self-shutting gate, with a rising hinge, the weight of the gate being taken by a friction roller on the double inclined plane.

Fig. 14 is a single-powered granary crane, with brake (drawn to $\frac{1}{2}$-inch scale), intended to lift 30 cwt.

(To be continued.)

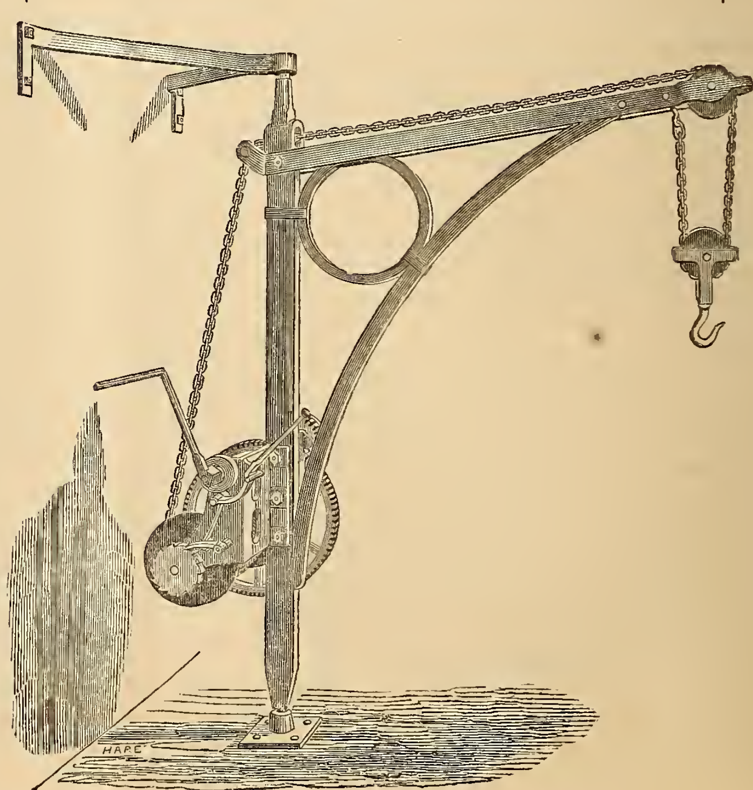


Fig. 14.

THE FOLLOWING IS THE PRIZE LIST OF THE ROYAL AGRICULTURAL SOCIETY.

For the plough best adapted for general purposes, 7*l.*—Messrs. Ransome and Co.

For the plough best adapted for deep ploughing, 7*l.*—Mr. William Busby.

For the best one-way or turn-wrest plough, 7*l.*—Messrs. Ransome and Co.

For the best paring plough, 5*l.*—Mr. Thomas Glover.

For the best subsoil pulveriser, 5*l.*—Messrs. J. Gray and Co.

For the best drill for general purposes, 10*l.*—Messrs. R. Hornsby and Son.

For the best steerage corn and turnip drill, 10*l.*—Messrs. R. Hornsby and Son.

For the best drill for small occupations, 5*l.*—Messrs. R. Garrett and Son.

For the best and most economical small occupation seed and manure drill for flat or ridged work, 5*l.*—Messrs. R. Garrett and Son.

For the best turnip drill on the flat, 10*l.*—Messrs. R. Hornsby and Son.

For the best turnip drill on the ridge, 10*l.* Messrs. R. Hornsby and Son.

For the best drop drill for depositing seed and manure, 10*l.*—Messrs. R. Garrett and Son.

For the best manure distributor, 5*l.*—Messrs. R. Garrett and Son.

For the best portable steam-engine, not exceeding 6-horse power, applicable to thrashing or other agricultural purposes, 40*l.*—Messrs. R. Hornsby and Son.

For the second best ditto, 20*l.*—Messrs. Barrett, Exall, and Andrewes.

For the best fixed steam-engine, not exceeding 8-horse power, applicable to thrashing or other agricultural purposes, 20*l.*—Messrs. Barrett, Exall, and Andrewes.

For the second best ditto, 10*l.*—Messrs. Ransome.

For the best portable thrashing machine, not exceeding 2-horse power, for small occupations, 10*l.*—Messrs. R. Garrett and Son.

For the best portable thrashing machine, not exceeding 6-horse power, for larger occupations, 20*l.*—Messrs. Garrett and Son.

For the best portable thrashing machine, not exceeding 6-horse power, with shaker and riddle, to be driven by steam, 20*l.*—Messrs. Clayton and Co.

For the best fixed thrashing machine, not exceeding 6-horse power, with straw-shaker, riddle, and winnower, that will best prepare the corn for the finishing dressing machine, to be driven by steam, 20*l.*—Messrs. Garrett and Son.

For the best corn dressing machine, 10*l.*—Messrs. Hornsby and Son.

For the best grinding mill for breaking agricultural produce into fine meal, 10*l.*—Mr. Hurwood.

For the best linseed and corn crusher, 5*l.*—Mr. Stanley.

For the best chaff cutter, to be worked by horse or steam-power, 10*l.*—Messrs. Richmond and Chandler.

For the best chaff cutter, to be worked by hand power, 5*l.*—Mr. Cornes.

For the best turnip cutter, 5*l.*—Mr. Samuelson.

For the best oil-cake breaker for every variety of cake, 5*l.*—Mr. Hornsby.

For the best one-horse cart for general purposes, 10*l.*—Mr. William Busby.

For the best light waggon for general purposes, equal merit, Mr. Crosskill and Mr. W. Ball.

For the best machine for making draining tiles or pipes for agriculture, 20*l.* —Mr. T. Scragg.

For the best instruments for hand use in drainage, 3*l.*—Messrs. Mapplebeck and Lowe.

For the best heavy harrow, 5*l.*—Mr. W. Williams.

For the best light harrow, 5*l.*—Messrs. J. and F. Howard.

For the best cultivator, grubber, or scarifier, 10*l.*—Messrs. Ransome & Co.

For the best pair-horse scarifier, 5*l.*—Mr. Charles Hart.

For the best horseshoe on the flat, 10*l.*—Messrs. Garrett and Son.

For the best horseshoe on the ridge, 5*l.*—Messrs. J. and F. Howard.

For the best horse rake, 5*l.*—Messrs. J. and F. Howard.

For the best horse dibbler or seed depositor, not being a drill, 10*l.*

For the best gorse bruiser, 5*l.*—Messrs. Barrett, Exall, and Andrewes.

For the best and most economical steaming apparatus for general purposes, 5*l.*—Mr. W. P. Stanley.

For the best dynamometer, especially applicable to the traction of ploughs, 5*l.*—Mr. Bentall.

Reaping machine, silver medal.—Messrs. R. Garrett and Son.

Improvement in plough wheels, silver medal.—Messrs J. and F. Howard.

Well machinery, silver medal.—Messrs. Tasker and Fowle.

Digging forks and farm tools, silver medal.—Messrs. Burgess and Key.

Patent double mill for hand power, silver medal.—Messrs. Ransome & Co.

ADAMS'S PATENT REPEATING PISTOL.

(Illustrated by Plate 14.)

As we have already described Col. Colt's pistol, so we now proceed to put our readers in possession of both sides of the question, by exhibiting the English variety, which has peculiar merits of its own. It is the invention of Mr. Adams, of the firm of Deane, Adams, and Deane, and is to be chiefly commended for the solidity of its construction, which gives greater strength, with less weight, than any other variety which we have examined. It does not require cocking, as the pulling the trigger raises the hammer; and upon this point the advocates on either side join issue. For hand-to-hand combat, where great delicacy of aim is not required, the advantage of rapid firing is said to be of infinitely greater importance than the occasional use of the pistol for long shots. From a trial of both Colt's and Adams's, we must confess that the former feels more to be depended on for a long shot, as the trigger is touched only at the moment of getting the sight. And yet, to show how much depends on practice, we saw, during some trials of rifles at Lord Ranelagh's, four shots out of five put into a target, three feet diameter, at 100 yards, from one of Adams's pistols! So much for knowing how to handle your "shooting-iron." So evenly balanced are the merits of the two plans, in our humble opinion, that when we design a novelty for our own use, it shall be made capable of being used *either way*; and this is the only method we see of escaping from the dilemma. But, as our readers will probably prefer our description to our theory, we will proceed to analyse Mr. Adams's patent pistol.

Fig. 1 is an end elevation, and fig. 2 is a side elevation, of the pistol, half size. Fig. 3 is a longitudinal section of the same, full size, a portion of the barrel being broken off. Fig. 4 is an end elevation of the trigger and the hammer-lifter. Figs. 5 and 6 (also full size) are front and back elevations of the revolving chamber. The barrel, *a*, it will be observed, is forged in a piece with the frame, *b b*, to which it is connected at top by the piece, *c*. The pin, *d*, is fitted into the stock, and is held in its position by a spring-catch taking into the notch, *e*, one side of which is bevelled, to allow the pin to be withdrawn when sufficient force is applied. A similar notch, *e'*, prevents the pin being entirely withdrawn, unless the spring is held back, thus preventing the pin being accidentally lost. On this pin revolves the chamber, *g*, which contains five charges, as shown in fig. 5. At the back of the chamber is fixed the ratchet, *h*, which is put on with two screws, as shown in fig. 6, so as to admit of its being readily renewed, when worn.

We have already said that the hammer is lifted by pulling the trigger, and this is effected in the following manner :—The hammer, *k*, moves upon the pin, *i*, and is pressed down on the nipple by the spring, *l*, to which it is connected by a swivel or link from the pin, *o*. The trigger, *m*, moves on the pin, *n*, and is kept in position by the pressure of the spring, *p*. To the back centre of the trigger, *r*, are attached the hammer-lifter, *s*, and the ratchet-pall, *t*. The point of the hammer-lifter, *s*, takes into a notch cut in the hammer, so that, as the trigger is pulled, the hammer is raised, until, as shown in fig. 3, the rounding portion of the hammer, acting like a cam, forces the lifter, *s*, out of the notch, and allows the hammer to descend on the nipple and explode the percussion-cap. In fig. 3, the hammer is shown just at the moment of its escape and descent; in fig. 2, the hammer is shown down on the nipple. When the finger is taken from the trigger, the end, *r*, and the lifter, *s*, descend, and the latter again slips into the notch ready for the next shot. It is obvious, however, that the lifter, *s*, requires to be kept in contact with the hammer, or else its action could not be relied on. This is ingeniously effected thus: at the back of the ratchet-pall, *t*, is a small, flat spring, the upper end of which is attached to the pall, whilst the lower end acts upon the lifter, *s*, as shown in fig. 4. As the lifter, *s*, turns on the centre, *r*, the pressure has to be applied *below* the centre, to press the *upper* end in the right direction, and the lifter, *s*, is prolonged below the centre for that purpose.

The rotation of the chamber is a very simple matter. The pall, *t*, when the trigger is pulled, acting on the ratchet, causes the chamber to revolve in one direction, whilst, at the moment of the release and descent of the hammer, the projecting tooth, *x*, of the trigger, acts as a stop, and prevents the movement of the chamber in the opposite direction. The notches, *z, z, z, z, z*, shown in fig. 6, permit the chamber to revolve until the stop-piece left at the end of each notch comes in contact with the tooth, *x*.

In order to load the chambers, it is necessary that it should revolve free of the stop. This is effected by a stop, which keeps the hammer slightly raised. A spring, *y*, is fixed at the side of the lock (see figs. 1 and 2), which has a pin (*y*, fig. 3) attached to the end of it. The hammer is raised slightly by pulling the trigger, and the spring, *y*, pushed in, which, by a notch cut in it, engages the hammer, and prevents it descending on the nipple. The chamber can then be loaded in the ordinary way; and when the trigger is pulled, the spring, *y*, is released, and flies back without any further trouble.

Figs. 7 and 8 are an elevation and plan of the bullet-mould, half size. The bullets are cast with a small tang upon them, which serves to fix a wad by. In loading, therefore, no ramrod is used, but the bullets are pushed in with the finger. The aperture of the barrel is slightly tapered outwards at the chambered end, to admit of the bullet entering it, when fired, more readily. The barrel is, of course, rifled, but the rifling is the reverse of the old-fashioned method, consisting of three feathers (to use an engineering term), and not grooves. This, in principle, is the same thing, the difference being, that the grooves are very wide in this pistol.

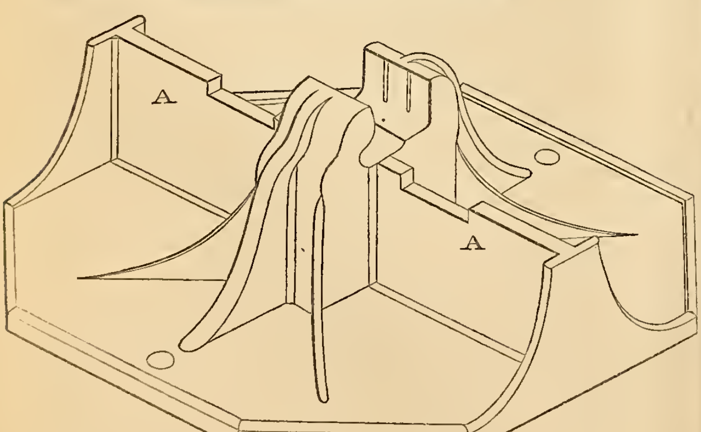
We take this opportunity of also noticing a very simple and ingenious

musket-lock, invented by Messrs. Deane, Adams, and Deane, shown in figs. 9 and 10, half size. There is only one spring, *a a*, the tendency of both arms of which is to rise; the upper arm has a projecting tooth, *b*, which throws over the hammer, *c*, while the lower arm is furnished with the notches which hold the hammer at half or full-cock. In the engraving, it is shown at half-cock. The projecting pin, *d*, is taken hold of by the trigger, in the usual way, and is pulled down when the hammer is to be released.

We have already given diagrams, and discussed the merits of the principal bullets which have been designed to facilitate the loading of rifles; and, as far as can be learnt, none of them appear to be free from defect. The great defect of the Delvigne or Minié ball (*ante* p. 76) seems to be, that the wrought-iron cup is liable to be driven through the ball, leaving an annular ring of lead in the barrel—an accident which puts the soldier *hors de combat*. To remove this objection, Messrs. Deane, Adams, and Deane have devised and registered a new form of ball, shown in section in fig. 11, and in external view in fig. 12, full size. It consists of two pieces, forming an interior and exterior cone, which being forced together by the explosion, causes the outer cone to expand, and fill the groove of the rifle. What, however, is of equal importance, at the present time, is its applicability to the ordinary musket, as the annihilation of the windage will improve the powers of that "queen of weapons" in a very great degree. The ring turned out of the outer cone is for the purpose of attaching the cartridge by. To show how these shot behave, when fired, we have engraved, figs. 13 and 14, the same shot when fired at an iron target. The identical bullet here sketched was fired from a rifle, with only one-eighth of a drachm of powder, against an iron target, at 37 yards distance. This distance is very short, and was only tried as an experiment; but the charge of powder is an equally homœopathic dose. To test its penetrating power, a similar bullet, *with the same charge* and distance, went through 3 inches of deal and a wooden powder-barrel filled with gravel. Further experiments are in progress with these shot, which we shall be able to lay before our readers as they occur.

REED'S IRON BLOCK CHAIRS.

In discussing the merits of the various modern forms of permanent ways (p. 147, vol. 1851), we omitted to notice Mr. Reed's patent chairs, a fact to which we are obliged to him for calling our attention. The date of Mr. Reed's patent, 16th October, 1845, appears to justify his claim to the invention of the cast-iron permanent way. The following description is communicated to us by the inventor.



Explanation.—The base is 22 by 20 inches, and $\frac{5}{8}$ of an inch thick. The turned-up margin is $\frac{5}{8}$ high and thick. The boss which carries the chair is hollow, and the sides $\frac{5}{8}$ thick. The bottom plate of the chair is $\frac{1}{2}$ inch thick. The side brackets are $\frac{3}{8}$ thick, and the brackets to carry the rail, A A, are $\frac{1}{2}$ inch thick. The rail which the Newcastle and Carlisle Railway Company are now (March, 1852) using in connection with these blocks, weighs $76\frac{1}{2}$ lbs. to the yard. The weight of this block is 80 lbs., and the joint block 86 lbs. The extent of bearing for the rail (in this case) is 20 inches, which admits of the blocks being laid 4 feet apart, centre and centre, leaving unsupported between them 28 inches, to compare with 33 inches, the length unsupported by the old method, 3 feet apart. This gives 1,980 intermediate blocks to the mile of railway, and 660 joint blocks. The former weighing 141 tons 8 cwt. 2 qrs. 8 lbs.; and the latter 50 tons 13 cwt. 2 qrs. 4 lbs. Together 192 tons 8 cwt. 0 qrs. 12 lbs.

These blocks are laid 4 feet apart from centre to centre, on the Newcastle-upon-Tyne and Carlisle Railway (the stone blocks and wood sleepers are invariably three feet apart), which deviation from the common practice, the increased bearance for the rail, renders available 21 inches in the place of 4 inches, which leaves the unsupported portion of the rail, 27 inches between the blocks, to compare with 32 inches of non-support in the other mode of laying. The nearer the blocks are placed to each other, the less will be the portion of the unsupported rail. This arrangement is one of the peculiar advantages connected with the block chair, by which the substitution of three blocks in place of four secures also an increased strength to the rail of one-sixth.

The block chairs are so much more readily laid down, that it has been practically ascertained the plate-layers with greater ease get over more than double the work, *i.e.*, they lay 80 of those blocks, or 107 yards of single rail, in the same time that 40 stone blocks can be laid down, which extend over 40 yards only.

The blocks are immoveable by the running of trains, requiring no tie-bars to preserve the parallelism of the rails, though provision is made for them, if required; they need little or no after attention, but when that is called for, the raising or shifting is very easily and rapidly effected.

From the entirety of the block and chair the dis-unity of parts is obviated; and in consequence of the extraordinary smoothness with which the trains pass over them, bearing on the rails is prevented; and as there is no possibility of the separation of the chair from the block, the hazard to which trains are constantly and fearfully exposed is removed, and no wood pins and iron spikes or screw bolts being needed, there is less liability to failure by the corrosion and decay of such adjuncts.

Stone blocks are liable to frequent breakage by driving down wood pins in the first instance, as well as from the expansion of the pins afterwards. Injurious results very often happen from frosts separating the stone blocks. Wood sleepers are even more objectionable, from being subject to rapid decay. These several consequences greatly endanger the running of the trains, besides causing frequent delays whilst the resulting repairs thereby required are in progress, which entail a never-ceasing outlay on the railway. These casualties are in no respect consequent to the iron block chairs; besides which, a further and no inconsiderable saving to the wear and tear of the rolling stock may be reckoned upon, from the easy running of the carriages over ways laid with them, which has been so obvious as to cause general remark.

And finally, it may be observed, that the durability and economy of the iron block chairs over those of stone blocks and wood sleepers is unquestionable. Their weight is arbitrary, but they may be safely adopted as low as 80 or 84 lbs. The general cost connected therewith is less than that of either stone block or wood sleepers, whilst the permanent advantage is incalculable, and whenever they are no longer wanted, their marketable value as old metal will be one-half the original cost, or possibly more.

COTTON AND ITS MANUFACTURING MECHANISM,

By Robert Scott Burn, M.E., M.S.A.

(Continued from page 146.)

In plate 13 we have given a longitudinal section of Mason's double beater lap machine; at page 144 we give a description of its arrangements and action; we now add the reference letters, by which this will be still further elucidated. The rollers, 1, 2, 3 (in the machine there are four sets of lap rollers, but the limits of the sheet only permitted three to be shown), represented by the dotted circles, are taken, filled from the lap machine, and placed in the slotted bearings, as in the drawing. By this arrangement, different qualities of cotton may be passed through the machine, each roller having a different supply from its neighbour. The periphery of the "lap" always rests on the endless apron, *f g*, revolving on the rollers, *s s*, by which the cotton is carried forwards to the feed rollers, *a a;* in passing from between which it is struck by the beater-bars, *b b*, the heavy impurities falling through the circular grating shown in the drawing; the tufts of cotton thereafter pass up the inclined plane, *c*, likewise grated, between the perforated revolving cages, *d d;* these are partially exhausted of air, by means of the fanners, *e e;* by this means a large portion of the impurities are withdrawn from the cotton as it passes between them. The cotton is next passed over the intermediate rollers, where it is formed into a species of lap, which is passed to the feed rollers, *f;* in passing between which it is subjected to the action of the second beater, *f;* it is then passed up the incline, *g*, between the second revolving cages, *h h*, and finally between the series of calendering rollers, *n, o o*, known as "Mason's Patent Condenser." This arrangement causes a very large quantity of cotton to be wound round the lap roller, which is placed in the slotted bearing at *p*.

The carding-engine, of which we give a section in plate 13 (longitudinal), is for medium numbers of yarn. The lap roller from the "blower" (of which we give a section in plate 13) is placed at *a a;* the lap is unwound from this; taken up by the feed roller, *b b;* from thenee taken by the licker-in, *c c*, and delivered to the main cylinder, *d d;* from this it is taken off by the cylinder, *e e;* from this it is taken by *f*, and re-delivered to the main cylinder, *d d;* in like manner the cotton is continually taken from and delivered to the card on the main cylinder by the strippers and rollers, *g, h, i, m, n, o, p, q, r, s;* being finally taken from the main cylinder by the doffer card cylinder, *t t;* from this it is stripped by the doffer, *v'*, which has a quick up and down motion given to it, by means of the crank, *v*, and shaft. The cotton, after passing from the doffer-knife, is taken through a trumpet-mouth, *x*, passed between calender rollers down the tube of the presser plate, and finally coiled in the interior of the revolving can, 2. A A is the framing, and B B the outer casing enclosing the carding cylinders.

There are two kinds of carding engines in use; these are "breakers" and "finishers." In the former, the fleece, when stripped off the doffer cylinder by the comb, is passed round the periphery of a roller. This roller is taken to the finisher carding engine, through which it is passed, and finally delivered to cans. Mr. Mason has patented a

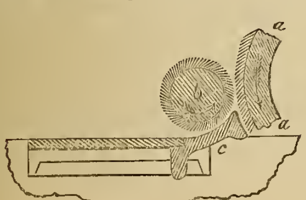


Fig. 1.

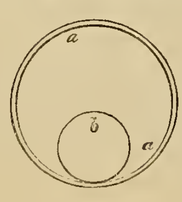


Fig. 2.

method of feeding carding engines, which is possessed of considerable advantages. In fig. 1 we give a diagram of this simple but ingenious contrivance. As the lap is taken from the roller it is passed to the card roller, *b*, over the edge of the curved plate, *c*, and from which it is taken up by the "licker-in," *a a*. The advantage derived from the use of this plan consists in the fibres of the cotton being held so much closer to the teeth of the "licker-in" whilst being operated upon. In the ordinary machine, the distance of the "licker-in" from the nip of the two feed rollers is at least $1\frac{1}{4}$ inch, while, by the arrangement now under consideration, the distance need not exceed a quarter of an inch. The fibres are thus taken hold of at both ends, and as each end is held by a card and not by pressure, the staple is not injured, but combed and pulled through the wire. The same arrangement is applied to the "double beater lap machine," of which we have given a section. The cotton fed by this means is found to be better cleaned than by ordinary methods, and a quantity of light leaf got out, ordinarily by other plans left in.

We have now to notice the methods adopted for coiling the slivers in the cans. It is evident that if the slivers were passed into the cans, and allowed to be placed in it just as might happen, a very short length only of sliver could find room in each can. In the machine of which we have given drawings, the coiling of the sliver in the can is effected in the following manner: The sliver delivered to the calendering rollers is passed down the tube of the pressing wheel, to which a horizontal circular motion is given; this consequently delivers the sliver to the can placed beneath it, in a circular direction, as *a a*, fig. 2; the pressing wheel, *b*, is placed eccentric to the can, *a a*, so that the sliver is placed in a circular coil in the latter; a slow rotatory movement is given to the can itself. By this double movement, the sliver is laid in the form of a continuous coil within it, and by this means a great length of coil is compressed in the interior of the can.

To effect this desideratum of having a considerable length of sliver in the can, the contrivance known as the "plunger" is also used. We give a sketch of this in fig. 3, where *b b* is part of the carding engine gearing; *d d*, a wheel receiving motion from the wheel *b b;* a stud, *e*, is placed eccentric to the centre of this wheel, *d d;* a band, *f f*, passes over the pulley *g*, in the standard, *h h;* to the end of *f f* a hollow metallic plunger is attached. This works up and down within the can, *m*, the plunger receiving an alternate motion by means of the band, *f*, and eccentric stud, *e e*.

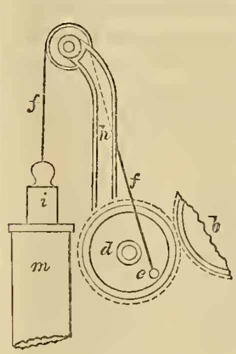


Fig. 3.

The patent contrivances for effecting the object now under consideration are very numerous; we purpose to notice one by Mr. James Hill, of Staleybridge. Above the can for receiving the slivers, a flat plate is placed; this supports the bearings in which two delivery or calendering rollers revolve. These are so placed, that the sliver is laid in the can in the direction of its semi-diameter, from the periphery to the centre, and *vice versâ*, alternately; this is effected by the arrangement in fig. 4, where *a a* is the can, *b c* the roller. As the sliver is passed from *b* to *c*, it will be laid in the can from its periphery to its centre, and while passing from *c* to *b*, from its centre to the periphery and so on; the movement of the sliver from end to end of the roller is produced by passing it through a guide or mouth-piece, which has an alternate movement given to it by a cam moving the bar on which it is fixed. A variable rotatory move-

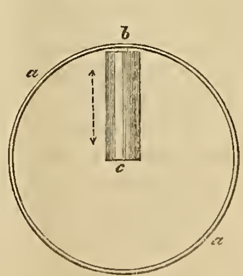


Fig. 4.

ment is given to the can as follows: A vertical driving shaft, *a*, fig. 5, which gives motion to the cam for moving the guide-piece, delivering the slivers to the drawing rollers, *b c*, fig. 4, has a crank, *b*, fixed on it near its lower extremity; this crank has a small pin, *c*, which is inserted in a radial slot made in the face of a horizontal toothed wheel, *d*. The centre of motion of the wheel *d* is eccentric to that of the vertical shaft *a;* this arrangement is shown in the plan, fig. 6, where *d d* is the horizontal wheel, *a* the vertical shaft, *e* the crank, with pin moving in the radial slot *d d*, the centre of which is at *e*. In the diagram, fig. 6, the crank pin, *c*, is in the position at which it is nearest to the centre of the wheel, *d;* the crank, *b*, driving the wheel, *d*, the latter will be moving at its slowest speed. In the diagram, fig. 5, the crank pin is at the point furthest from the centre of the wheel, *d*, and, consequently, the latter is at its quickest speed. The amount of variation is thus made dependent upon the degree of eccentricity the wheel, *d*, has to the vertical shaft, *a*. The can in which the slivers are coiled rests upon a plate, the circumference of which is toothed and gears into the wheel *d d;* the can, in this manner, partakes of the variable motion of the wheel, *d d*. By this arrangement, the sliver is first laid loosely in the can, and afterwards compressed. The method patented by Messrs. Lakin and Rhodes, of Ardwick, near Manchester, is deserving of notice; its principle of arrangement is shown in fig. 7. *a a*, the delivery or calendering rollers; the slivers are delivered to the trumpet-mouthed guide-piece, *b b;* this oscillates on a stud near the top, and a reciprocating motion is given to it by the connecting rod or lever, *d*, one end of which moves on a centre at *c*, and on the other at the stud, placed in the face of the wheel, *e*, eccentric to its centre of motion. The sliver is laid in regular layers in the can placed beneath it, alternately from *g* to *f*, and *vice versâ;* the can moving on a small railway, in a direction parallel to the drawing rollers, lays the sliver side by side.

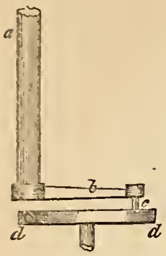


Fig. 5.

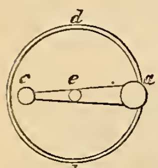


Fig. 6.

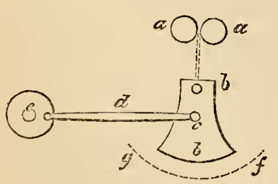


Fig. 7.

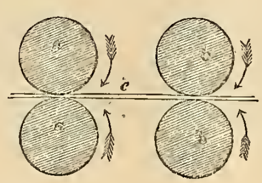


Fig. 8.

We have now to notice the machine next in sequence; this is the "drawing frame." The operation to be effected by this machine is the still further parallelisation of the fibres. This is done by drawing out or lengthening the slivers to a state of considerable tenuity; they are then doubled, that is, several slivers put together, drawn through a trumpet mouth, and passed through drawing rollers. The *rationale* of the drawing process may be described by the aid of the diagram in fig. 8. Suppose two sets of rollers, *a a*, *b b*, revolve at the same speed; a sliver, *e*, passed between them would be equally pulled through, that is, it would pass from the last pair of rollers at the same velocity as it entered the first pair; but if the pair *a a* revolved twice as fast as *b b*, it is easy to perceive that the result would be the elongating of the sliver somewhere between the two pairs; inasmuch as the last pair taking in twice as much sliver as the first, and these latter only delivering half as much as can be passed through *b b*, the necessary consequence is that the sliver is pulled out or lengthened just in proportion to the difference between the speed of the two pairs of rollers. In the drawing frames in use there are three pairs of rollers, but the drawing out of the fibres is produced by the first and last pair. The distance between the rollers is regulated according to the fineness of the staple of the cotton operated on. The front rollers are generally fixed, the others revolving in moveable bearings. The drawing process is one of great importance in the cotton manufacture; in fact, the correctness of the after-processes depend altogether upon the manner in which the drawing is effected. The slivers, as they come from the carding engine, are comparatively irregular in their fineness; that is, two different and equal lengths may contain different quantities of cotton; again, the parallelisation is very defective in some instances; thus, a card tooth may catch a fibre by the middle and bend it up or double it. Several slivers from the finisher carding engine are passed through the drawing rollers, generally eight; these are delivered in the form of a sliver, having the quantity of eight carding slivers in it, of the same density as each of them separately, thus increasing eight-fold the chances of uniformity in the sliver. Four of these slivers are again passed through the drawing rollers, and delivered in the form of a single sliver, the chances of uniformity being thirty-two-fold. This "doubling," as it is termed, in fine counts, is carried on to a great extent; in some instances it is repeated till the fibres have been laid parallel to one another nearly 100,000 times.

In the plates accompanying this series of papers we shall give drawings of this machine.

(To be continued.)

THE SCREW AND PADDLES COMBINED.*

By J. Bourne, C.E.

I am not aware that there are any vessels in actual existence which are propelled by the conjoint action of paddles and a screw, but some years ago I proposed the establishment of vessels of this kind, under circumstances which it will require a slight digression to recite.

The Peninsular Steam Packet Company, of which the Peninsular and Oriental Steam Packet Company is a subsequent extension, was established by my father, the late Captain Bourne, who advanced more than half the capital necessary for the establishment of the company himself, while the residue was chiefly contributed by his brothers and other members of his family. The *Tagus*, *Braganza*, and other original vessels of the company were constructed under my direction, and they were generally considered to be the best vessels of their time; but for many years I have ceased to have any further connection with the company than is implied in an interest in its success, and a desire to see it prosper. For some years past, however, its original reputation has been on the decline; the original vessels had become old and slow, and some of them had been lost, while the new vessels which had been added to the company's fleet, instead of being better than the old, were in most cases worse, so that the *prestige* with which the company started was no longer maintained.

The result of this state of things was, that various proposals for establishing a rival company were entertained; and it became obvious to me that, if a rival company were established, one of two consequences would ensue—either the new company would get the mails to carry, or if the old company succeeded in retaining them, it would only be after such a keen competition, and on such stringent conditions, that the service would hardly repay any contractor. Under these circumstances, I communicated with my father, who was then still living, and with some of the other directors of the company, pointing out the course which it appeared to me ought to be pursued under the circumstances related; and my recommendations were to the following effect.

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* From Treatise on the Screw Propeller, by J. Bourne.

It was quite clear that the very general dissatisfaction which had been expressed at the want of power and speed in the company's vessels was not unfounded. Here was a line, confessedly the most important of all our lines of postal communication, on which the vessels built ten or twelve years before were still the best, the more recent vessels being, for the most part, exceedingly slow and inefficient, when compared with other successful vessels of recent construction. It was quite indispensable, therefore, in order to meet the just expectations of the public, that vessels capable of maintaining a higher rate of speed should be introduced; and as the introduction of such vessels by some party or other was inevitable, it would not be advisable to postpone the improvement until the attempts of rival parties had been so far organised, that competition could no longer be averted by any expedient of amelioration. All this was very clear; but the question at once arose, what was to be done with the existing vessels? Attempts had been made to accelerate some of them by the application of feathering wheels, but with very inadequate results; and all attempts at petty improvement appeared to me not merely futile, but injudicious, as such attempts involved a considerable expense, and practically left the vessels still unequal to the exigencies of their vocation. Now, seeing that it would be impossible to sell the existing vessels without immense sacrifice, and that it would be equally impossible to retain them, unless a radical change in their efficiency could be effected; and seeing, too, that the usual means of acceleration had been tried, at a heavy expense, but without any material benefit, it occurred to me that, upon the whole, the most judicious course would be to introduce into each vessel a separate engine, which would drive a screw, working in the stern of the vessel, in aid of the paddles; and by this arrangement it was obvious that any increase of power and speed might be given to the existing vessels that the exigencies of the case required. I recommended, therefore, that one of the smaller vessels of the company, the *Madrid*, for example, should have a screw fitted at the stern, to aid the operation of the engines; and I found that a pair of screw engines, of the same power as the existing paddle engines, of 140 horses power, could be supplied for about £800; the screw engines being light and cheap, as they would be without air-pumps and condensers, and would be connected immediately with the screw-shaft. If the result answered the expectations formed of it, a similar arrangement could, it was obvious, be introduced into the larger vessels without any very great expense, and those vessels would thus be enabled to maintain a rate of speed exceeding anything then existing in ocean steam navigation, and the dilemma in which the company stood of having to discard their present vessels, or lose the mail contract, would be dissolved.

This suggestion has met with the same reception and the same fate as that which I had previously made for the better ventilation of the vessels. At first it was looked upon in the light of a great deliverance; but it has since been suffered to languish and die out, my father's advanced age, and subsequent illness and death, having prevented him from taking those active steps for its furtherance which otherwise he would have felt called on to pursue. The mechanical part of the question was referred to Mr. Penn for his opinion, whose views completely coincided with my own, the only difference being, that he stated them with greater clearness and force than I should have been able to do. Other leading engineers to whom the proposed arrangement has since been mentioned concur in the conclusions at which I had arrived. As every one of ordinary engineering attainments will be able to form a judgment for himself upon this subject, I shall here recount the nature of the intended arrangements, and the extent of the benefit which, according to my estimate, would have been obtained.

I have already mentioned, that if the power of any given vessel be doubled, her speed will be increased nearly in the proportion of the cube-root of 1 to the cube-root of 2. A vessel, therefore, which maintains a speed of 10 knots with any given power, will maintain a speed of about $12\frac{1}{2}$ knots with twice the power; and I proposed that the power of all the Company's vessels running on important lines should be doubled wherever the usual speed did not exceed 10 knots an hour. Now this duplicature of the power I proposed to accomplish without touching the existing engines at all, and, as I have already mentioned, I proposed to apply a screw in the stern of the vessel, which was to be driven by separate direct-acting engines of its own. The screw engines would not have had either air-pumps or condensers; but the steam from the boilers were to enter the screw engines first, and after having given motion to them, would have passed into the paddle engines, where it would have been condensed in the usual manner. By this arrangement, the steam would have been used twice over, and twice the amount of engine power would have been exerted in the hour, without any increase in the consumption of coal. To enable these arrangements to be carried into effect, it would be necessary to work with a higher pressure of steam than has heretofore been employed in these vessels; and I proposed to use a pressure of about 25lbs. on the square inch, which was about three times the pressure then employed. To enable this pressure to be used with perfect safety, I proposed that the boilers should be circular—such as Mr. Penn has since put into the *Hydra*, which may be worked up to 30 or 40lbs. on the square inch, if required. It would, of course, be impossible to put any such pressure as I proposed to use upon the existing paddle engines, as it would have broken them down; but the steam was to act, in the first instance, upon the pistons of the screw engines, after having given motion to which, it would pass into the paddle engines, and be there condensed in the usual manner. There is, therefore, only the same quantity of steam to be generated under the new arrangement as under the old, and it would be generated, of course, with the same quantity of coal: but after having been employed in the cylinders of the screw engines, and been there expanded down to that point of elasticity with which the paddle engines at present work, it was to be conducted into the paddle engines, and to work them in the same way as if steam of that elasticity had come direct from the boiler. The proposed arrangement, therefore, is analogous to that of a Woolf's engine; but as the engines employed to drive the screw would work at a high velocity, they would be smaller than the high-pressure cylinders of a Woolf's engine, in the proportion of their increased speed.

It will be obvious, from the exposition I have given in the foregoing pages of the mode of action of the screw in the water, that a screw acting in aid of paddles would work far more efficiently than if it were employed alone to propel a vessel; for, as the vessel is at all times moving through the water from the action of the paddles, the screw will always have a column of water of a considerable length to act upon at each revolution, and the slip will be diminished in consequence. And as, by the operation of the paddles, the action of the screw is amended, so will the action of paddles be amended by the action of the screw. For, since the vessel will pass faster the water when an auxiliary screw is added, the paddles will gear into a greater length of water in a given time, which, as it will possess more inertia without any more pressure being employed to move it, will be operative, to a corresponding extent, in reducing the slip of the wheel. In fact, both propellers will act constantly under the same favourable circumstances as if the vessel were always sailing with a fair wind; for the screw is virtually a fair wind to the paddles, and the paddles are a fair wind for the screw.

It will be further obvious, that by adding to a paddle vessel screw engines of the same power as the paddle engines, the total power of the vessel will be somewhat more than doubled; for, when the speed is increased from 10 to $12\frac{1}{2}$ knots, the speed of the paddle engines will be increased also, so that they will give out a fourth more power than before; and the increased speed of vessel due to this small increase of power will, in its turn, somewhat increase the speed and power of the screw en-

gines. But this increase of the power I have not thought it necessary to reckon, seeing that it would only be obtained with an increased consumption of fuel, and that the speed of the vessel will not increase quite so rapidly as the cube-root of the augmented power. Now, if the speed of the vessel be increased one-fourth, and the consumption of fuel, per hour, only remains the same, it is clear that the vessel will require one-fourth less fuel for the accomplishment of a given voyage. Instead, therefore, of the vessels employed upon the Indian line having to carry about 600 tons of coal, they would only require 450 tons for the performance of the same voyage under the proposed arrangement, and the weight thus saved would fully compensate for the extra weight of the screw engines and screw.

From these considerations it appears, beyond doubt, that, by the proposed mode of acceleration, about one-fourth more speed would have been obtained with a smaller consumption of fuel, and without any increased weight in the vessel. The only topic remaining for consideration is, whether boilers using such a pressure as 25 or 30 lbs. would be quite safe in steam-vessels, seeing that the boilers of steam-vessels sometimes get incrusted with salt, when, possibly, the furnaces may get red-hot. Now, it is quite clear that any boiler which is suffered to get red-hot, from whatever cause, will be productive of danger; but such an occurrence is a very rare one; and I consider that the risk of salting may be obviated by an expedient mentioned to me by Mr. Penn, as a suggestion of Mr. Spiller's, and which appears to me to afford a perfect security against the danger. This expedient consists in the application of a feed-pump, which is purposely made too large to supply the quantity of water requisite for the generation of the steam, and which is not provided with any means of shutting off the water, or allowing the surplus to escape. It will follow, consequently, that a good deal more water will be sent into the boiler than what can be raised into steam, and the surplus must be blown out by the engineer; or a self-acting float may be applied to the boiler, to permit its escape when the level of the water rises above a given point. With this simple provision it will be impossible that the flues of the boiler can ever become incrusted to an inconvenient extent, whether the boiler is leaky or not; and any objection based upon the supposition of such a possibility must of course disappear when the possibility itself no longer exists. The question, however, is not so much whether boilers with a pressure of 25 or 30 lbs. may be made as safe as boilers of a much lower pressure, but whether they may be made as safe as boilers with nearly the same internal pressure, but which are by no means adapted to sustain it. In modern sea-going steam-vessels, 20 lbs. on the square inch is a frequent pressure; and in a few instances the pressure is as high as 25 lbs.. These boilers, nevertheless, have flat sides, and depend for their strength upon stays, which after some time corrode, and may even be eaten through, leaving the boiler in a very unsafe state. The pressure, indeed, is always reduced in these vessels, as the boiler gets into a state of dilapidation; but such an adjustment rests the responsibility of the safety of the boiler upon the engineer, and is a practice likely to lead to accidents. Instead, therefore, of loading the boiler at the first to its maximum strength, and gradually reducing the pressure as it gets into disrepair, it appears to me to be by much the safest course to make the boiler of such a construction, at the outset, as to enable it, without the aid of stays, to withstand a very much higher pressure than is put upon it; and it will then continue to be safe even when old and worn. This, accordingly, is the course which I proposed to pursue, and it still appears to me to be the most eligible that could be adopted.

Such, then, were my recommendations to the Peninsular and Oriental Company, while there was yet time to avert the injurious consequences which have since ensued. After great vacillation and delay, they were eventually neglected. A rival company was formed, which competed with them for the conveyance of the mails, and the result is, that, instead of 19*s.* 10*d.* per mile, which they formerly obtained for carrying the mails from Calcutta to Suez, they now only get 6*s.* 4½*d.* per mile. At the same time, an increased rate of speed has to be maintained, which is of course tantamount to a further reduction of the payment. In fact, their position upon the Red Sea line is now this, that they would be better without the mails than with them, as the mere expense of the increased quantity of fuel necessary to realise the increased speed which they have undertaken to maintain will swallow up the whole of the Government subvention. To increase the speed of a vessel from 8 to 10 knots, it is necessary that the engine-power should be doubled; and under any other arrangement than what I suggested, the consumption of fuel will be increased in about the same proportion as the increased power. Now, taking the average cost of coals on the Red Sea line at 50*s.* per ton, including labour and waste, and the average consumption per hour at 30 cwt. in the existing vessels, there will be about three tons per hour burned with engines of double the power. The cost of fuel will therefore be at the rate of £7 10*s.* per hour, or 15*s.* per knot, supposing the power to be doubled, as will be necessary to realise a minimum speed of 10 knots. This is between 6*s.* or 7*s.* more than the present cost of fuel per mile, so that the whole sum given by government will, on this line, barely cover the additional outlay for the fuel necessary for the maintenance of the increased speed. But the increased cost of fuel is only a part of the new expenses which must be incurred to realise this increased speed, since it can only be given by new vessels. It is a condition of the new contract, that the vessels, before they are accepted for the service, shall be able to accomplish a speed of 12 knots, at the measured mile, when sunk to the load-water line. This appears to me a very proper condition, as it insures the services of vessels of an efficient character, instead of leaving a constant loophole for inefficiency by casting the blame of delays upon the weather instead of upon the ship. Of the whole of the Peninsular Company's fleet of thirty ships, it is, however, doubtful if there is a single one capable of satisfying this condition. Here then, notwithstanding the large expense incurred for repairs and microscopic ameliorations — the *Bentinck* alone having cost from £35,000 to £40,000 in this way, and most of the other large vessels similar sums, being, in fact, more than could be got for them if they came to be sold —there remains the same inability as before to realise the speed necessary for the proper performance of the mail service and new vessels must, after all, be built. What then is to be done with the old? Upon lines where a high rate of speed is not required, they are incapable of maintaining a competition with screw vessels. Upon lines where a high rate of speed is required, they are unable to achieve it. If sold, they will bring very little, for no one stands in need of such vessels. If retained, they will be only so much lumber, representing a large capital, but of little actual worth. Even these, however, are no longer the most momentous topics for consideration. To achieve the higher speed necessary under the new contract for the conveyance of the mails, vessels of greater power must be employed, and while the receipts are diminished and the expenses increased, a dividend must, at the same time, be paid upon a larger capital. The average duration of the Red Sea passage by the company's vessels, for 12 months ending 1851, was from Calcutta to Suez 28 days, and from Suez to Calcutta 24 days, including days of arrival and departure, and stoppages at Madras, Galle, and Aden. The average time both ways will therefore be about 26 days; and allowing 4 days for the stoppages at Madras, Galle, and Aden, and for the unconsumed portion of the days of arrival and departure, which will be about the proper allowance, we shall have 22 days for the duration of the voyage under steam. The distance from Calcutta to Suez is 4,757 knots, which gives an average speed of 9 knots an hour. Now, vessels maintaining an average speed of 9 knots will be able to

engage to give a contract speed of 8 knots with a tolerably fair assurance of being able to keep their time, though it would be desirable that the difference between the average and contract speeds should be greater than this. The contract speed being, in point of fact, the minimum speed, except where some very unusual circumstances of retardation occur, it is clear that the average speed must, in all cases, considerably exceed it, else the vessel will be perpetually behind her time; and on any line exposed to vicissitudes of wind and sea, the difference of a knot an hour between the mean and contract speeds is the least that can be safely allowed; and if the contract speed be increased to 10 knots, then the average speed must be at least 11 knots an hour. If, then, it be the fact, that on the Red Sea line the increase of the contract speed from 8 knots to 10 knots involves an increased expense for coals which consumes the whole of the government contribution, so that the existing vessels could realise the same profits at their present speed without that contribution, as vessels of the power necessary for the attainment of the increased speed with that contribution, then it is clear that screw vessels with auxiliary power will realise larger profits still, and that such vessels, if set upon this line, will, in point of fact, be much more profitable without a contribution of 6*s.* 4½*d.* per mile than vessels requiring to maintain an average speed of 11 knots an hour, can be with that contribution. Passengers, indeed, will, other things being equal, prefer swift vessels to slow ones; but if screw vessels on the Red Sea were to work in conjunction with the vessels of the Austrian Lloyd's from Alexandria to Trieste, passengers would be able to proceed by this line from Calcutta to England in about the same time as if they proceeded in the vessels of the Peninsular Company from Calcutta to Southampton. What was lost in time on one side of Suez would be gained upon the other side, so that the total duration of the voyage would be much the same in both cases. The expense of the voyage, however, would be much less by the screw vessels; and those vessels, moreover, would be able to carry cargo, whereas, in the vessels of the Peninsular and Oriental Company at present plying between Calcutta and Suez, about 80 or 100 tons of cargo is all that can be conveyed. Heretofore, indeed, it has been supposed that screw vessels could not ply advantageously in the Red Sea, which is a narrow tract of water, with the wind blowing down it for 11 months of the year; and with the inability to tack, and with these winds necessarily ahead in one direction, it was concluded that, of this sea at least, paddle-vessels would retain the monopoly. In the permanency of any such impediments, however, I never had the least faith; for, although heretofore screw vessels have been unable to proceed head to wind without a most extravagant expenditure of fuel, or, if of small power, have been unable, under such circumstances, to proceed at all, I have always been confident that this defect would be corrected; and in the foregoing pages the means for accomplishing this correction have been pointed out. Henceforward, the Red Sea may be navigated by screw vessels with the same facility as the Mediterranean, and such vessels will certainly supersede paddle vessels in all cases in which the paddle vessels are not supported by a Government contribution sufficient in amount to cover the increased expense incident to their employment. A contract which engages to give a high rate of speed for a small rate of mileage, is an encumbrance rather than a benefit; and whereas heretofore the terms of the contract for the conveyance of the Indian mails gave the Peninsular and Oriental Company a virtual monopoly of the eastern seas, the conditions are now so completely changed, that any new party could compete with them on at least equal terms. I cannot come to any other conclusion than that this consequence would have been in a great measure averted, if my recommendation for the acceleration of their vessels had been adopted at the time it was given; and if this be so, any one who has prevented its adoption, without the realisation by any other or better means of the benefits it promised, has certainly incurred a grave responsibility, and has disentitled himself to confidence in his future representations. It is in vain to contend with physical fact; for, although it may apparently be stifled for the moment, it will at length manifest its existence by the consequences which it entails. Some of the consequences of this fatal error are visible already; others I foresee, but I will leave their revelation to time.

These comments have extended themselves to such a length, that the remarks I have to offer respecting the comparative advantages which vessels propelled both by the screw and by paddles would offer relatively with those presented by vessels propelled by either screw or paddles alone, must be dispatched very summarily. It is only in the case of vessels intended to maintain a high rate of speed, upon voyages of considerable length, that I would propose to employ both the screw and paddles; but in those cases the combination has very obvious advantages, if the comparison be made with that measure of efficiency which screw and paddle vessels have heretofore respectively attained. Paddle-vessels, when deeply, are unable to exert their power with good effect; whereas, under those circumstances, the screw acts in its best manner. On the other hand, a screw-vessel set to encounter a head-wind wastes much of the engine-power in slip; and the performance would be improved, under such circumstances, if half the power were withdrawn to work paddles, since not only would the paddles act in such a case with great efficiency, but the advance they would give to the vessel would enable the screw to act with greater efficiency also, as it would be perpetually coming into a fresh body of water, whereby the slip would be reduced. A vessel, therefore, propelled by paddle engines of 500 horse power, and by screw engines of 500 horse power, would be more efficient, when deep, than the same vessel propelled by engines of 1000 horse power driving paddles; and more efficient, when set to encounter head winds than the same vessel propelled by engines of 1000 horse power driving a screw. In fact, by the proposed combination, a higher average measure of efficiency would be attained, and in so far as the screw engines would be lighter and more compact than paddle engines of the same power, a further benefit to that extent would be obtained also. The paddles, moreover, would not require to be of such inconvenient dimensions as if the whole power had to be transmitted through them, and yet a very effective hold of the water would be obtained. Should either the paddles or the screw be deranged by any accident and be unable to work, the vessel would still be able to proceed by the remaining instrument of propulsion, at a diminished rate of speed. Upon the whole, therefore, I am of opinion that vessels constructed on this plan will be better than if propelled solely by paddles, and they will be better also than vessels propelled solely by the screw, if the mode of applying the screw be the same as that which has been heretofore in use; but they will not be better than vessels propelled solely by the screw, if the screw be applied in the manner I have recommended, so as to enable screw vessels to proceed in an efficient manner against a head wind. It is mainly, however, as a means of accelerating the speed of existing paddle vessels that the plan is to be recommended, and I do not know of any mode by which an effectual measure of acceleration can be ensured with so small a disturbance of the existing mechanism, and at so small an expense. In reflecting upon the various means of accelerating vessels, when I first entered upon the consideration of this subject, other modes, as may be supposed, suggested themselves of accomplishing the same object. One of these modes was the use of feathering wheels, and the reduction of the diameter of the wheels, so that a higher velocity of the engine would be obtained. But this expedient, it was obvious, would only fall into the category of petty ameliorations, since it would be impossible to reduce the diameter of the wheel very much in vessels of a varying immersion without introducing other evils; and it did not appear advisable, moreover, to in-

crease the speed of the engines very much beyond that at which they then worked, as many of the arrangements were not suited to a high velocity. Another idea was to interpose gearing between the engine and the paddles; but this expedient had much the same objections as the preceding; and if either of these plans could have been carried into effect, it would have been necessary to increase the area of the floats in the proportion of the increase of power, else the slip would have been augmented. In both of these plans, moreover, the consumption of fuel would have risen in the same proportion in which the power was increased; whereas, by the application of an auxiliary screw in the manner I contemplated, the increase of the power would not have occasioned any increase in the consumption of fuel per mile, but would have been less than before. In all cases, therefore, in which it is desirable to increase largely the speed of a paddle vessel, that object will, in my judgment, be best attained by the introduction of an auxiliary screw worked by direct-acting engines, which receive steam of a considerable pressure from boilers of appropriate construction, and transmit the steam in an expanded state to the paddle engines, to be there condensed in the usual manner.

DEFECTS OF ROTARY ENGINES.

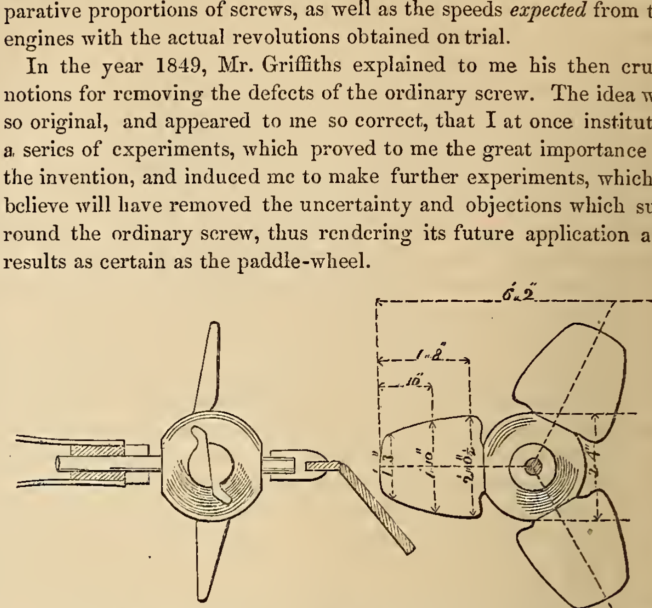
A correspondent, who appears very sanguine that he has solved the problem of a perfect rotary engine, has requested us to state what are the defects which have prevented the attainment of success in all previous attempts. The leading defect is easily shown in the following way:—Lay two penny pieces on each other. Let one represent the end of the revolving drum, and the other the end of the case or cylinder. It is obvious, by turning one round, that any point at the circumference travels at a greater speed than any other point between it and the centre, and the wear is therefore unequal, being greatest on those points moving the fastest. It is easy to say that this may be obviated by elastic packing; but in practice we have never seen it done satisfactorily. By means of end plates, the points of bearing may be transferred to the circumference, and they would resemble the piston of an ordinary reciprocating engine, which should revolve on its centre. But the high rate of velocity would make the wear very great. If our correspondent has overcome this difficulty, he has made an important step in advance. We may refer him to our remarks on Borrie's engine and a variety of others, at p. 167, vol. 1844, and on Davies', at p. 115, vol. 1849.

GRIFFITHS' PATENT SCREW PROPELLER.

The screw propeller has now become so important a feature in steam navigation, that I have thought it a subject of sufficient interest to induce me to bring under the consideration of the public some most important experiments made under my own directions upon a new propeller (Griffiths' patent), which is, in its form and general principles, diametrically opposite to the screws adopted by the Government, and by all the marine engineers of the present day.

The screws generally used are formed of two blades continued down to the shaft, the boss or centre being reduced to the smallest possible size consistent with strength. The Government, by their elaborate experiments with the *Rattler*, *Minx*, &c., appear to have determined thus far the general outline principles for constructing the screw; but the correct pitch, diameter, and length, as well as the number of blades necessary for obtaining the best results, are still matters upon which scarcely two engineers agree; and the equally important point, the correct speed to drive the screws, is still a greater matter of doubt; and notwithstanding the great labour and expense that has been bestowed on the subject by many engineers of eminence, to whom we are indebted for bringing the subject to its present state of practical utility, yet there appear no fixed and certain rules arrived at for constructing the screws, and determining the speed at which they shall be driven to produce a given result. On reference to Mr. Murray's valuable work on Steam Vessels and the Screw, table 7, pp. 209, 210, it will be found, on comparing the various vessels in Her Majesty's navy, that the most singular instances occur in the comparative proportions of screws, as well as the speeds *expected* from the engines with the actual revolutions obtained on trial.

In the year 1849, Mr. Griffiths explained to me his then crude notions for removing the defects of the ordinary screw. The idea was so original, and appeared to me so correct, that I at once instituted a series of experiments, which proved to me the great importance of the invention, and induced me to make further experiments, which I believe will have removed the uncertainty and objections which surround the ordinary screw, thus rendering its future application and results as certain as the paddle-wheel.



The drawing represents one of Griffiths' propellers, which was made at my factory, for the *Ranger*, a vessel of 297 tons, by Miller, Ravenhill, and Co. Cylinders, 27 inches diameter, 2 feet stroke; revolution of engines, with ordinary screw, 60 per minute; multiple of gearing, $2\frac{1}{2}$ to 1. It will be seen that the form of this propeller is opposed to all the received notions of a correct screw propeller. The first leading feature is, that, instead of continuing the blades down to the shaft, and keeping the centre boss as small as possible, one-third of the entire diameter is fitted up as a sphere. In the experiments which Mr. Griffiths and myself made, we ascertained that the centre part of the blades of the ordinary screws absorbed 20 per cent. of the power, without having any propelling effect, in consequence of that part of the blades (particularly in coarse pitched screws) being nearly in a line with the shaft, the effect being, when working, to hurl the water off, by its flapping and centrifugal action, at right angles to the shaft, and seriously disturbing the more solid water upon which the more effective portion of the screw should act. The great vibration at the stern of all screw vessels arises from this flapping action of the flatter portion of the blades in their downward course, striking the denser water below them, which, affording a greater resistance than the water above the blade, in its upward course, produces this evil vibration, at an enormous sacrifice of power. The effect of this destructive action can be appreciated by the fact, that screw vessels, if trimmed, say 2 inches by the stern, when under canvas or at anchor, will suddenly be 2 inches down by the head the moment the engines are set to work. In point of fact, a large amount of engine-power is exerted in lifting the stern of the ship out of the water by the action of the flat part of the screw-blades, as described.

The ball shown in the drawing is made to cover this destructive portion of the screw-blades, or is rather substituted for the central third portion of the screw. It will be seen that the power required to revolve this in the water at a great velocity is insignificant compared with driving two or three comparatively flat blades of same diameter, which may be fairly compared to the centre of a centrifugal pump. That there can be no tendency to vibrate the stern of the vessel, is obvious; nor does the trim of the vessel alter in the least degree when under the action of the patent propeller. Moreover, from the water not being violently agitated by the centrifugal action, the effec-

tive part of the propeller's blades is screwing in stiller and more solid water, producing a better result, and with a considerable less amount of slip. The water leaves the propeller in a direct line with the vessel, and without the commotion resulting from the ordinary screw. The strength of the screw is much increased by this form, which also affords great facility for replacing the blades, in case of accident, to which screw-vessels, in channel and river navigation, are peculiarly liable.

The second important feature is the form of the blades, which, instead of being larger at the extremities, *are precisely the reverse.* The best form I have found to be, as shown in the drawing, the full diameter of the sphere at the root, and tapering to $\frac{2}{3}$ of this size at the periphery, at which part they are about $\frac{1}{3}$ only of the size of the ordinary screw; and with these proportions, so complete is the hold this propeller has upon the water, that I have had, in practice, even to reduce the diameter considerably below the ordinary screw.

The water which follows the wake of the ship, and what the sailors call the "*dead water*," may be compared to the eddies below the piers of a bridge through which a rapid tide runs, and where, as every one knows, the water is "*dead,*" or in a state of rest, the more so at the very centre of the pier. In a precisely similar condition is the dead water of a vessel, the water being most solid towards the centre, and gradually becoming less so, until mixed in the current running beyond the width of the ship. It must be obvious that the nearer the work can be applied to the screw-shaft the better mechanical result will be obtained. The arrangement of the blades of the patent propeller (as shown in the sketch) has been so contrived, that their broad part is made at the ball, so that advantage is taken of the central solid dead water just described, to obtain the utmost duty from the propeller-blade at its root, or as near the screw-shaft as the central ball will admit. The blades are reduced towards the periphery, to meet the difference of velocity they travel through the water. So effective is the hold of these blades upon the water, from the causes described, that I have found, in practice, the speed of the propellers can be reduced, with the greatest advantage, one-third below the velocity found necessary for the ordinary screw—a fact which every engineer will admit to be of great value, seeing the many mechanical difficulties which present themselves in obtaining the speed hitherto considered necessary (see table of experiments).

The screw has hitherto almost entirely been applied as auxiliary power, and, where large power has been employed, has never yet been made to equal the speed of the paddle-wheel. The imperfections of the screw appear hitherto to have placed a limit on the speed it was possible to obtain.

In those vessels where a large amount of engine-power was applied, no adequate increased speed was obtained; and in the case of the *Rifleman* and others, which were altered, and the engine-power absolutely reduced one-half, as good a result was obtained as with the larger power, showing that, beyond a given power, the water is screwed through the screw, instead of the vessel being screwed through the water. This action takes place in all screw-vessels to a most serious degree, when going head to wind, or in towing, when the engines make their full number of revolutions; but have little effect in propelling the ship. The perfect hold that Griffiths' propeller has also, under such circumstances, upon the water, bids fair entirely to remove these difficulties, and will tend greatly to increase the value of the screw as a propeller.

The patent propeller was appplied to a tug-boat—the *Lady Emily*, 12 horse-power, diameter of screw, 3 feet 8 inches—on the Kennet and Avon Canal, under the direction of Capt. Morrice, R.N., the manager, and the results showed that with one barge laden with 60 tons she went from Bath to Bristol, deducting stoppages going through locks, in $2\frac{3}{4}$ hours, the distance being 18 miles. As other barges were added, the speed was reduced, and the engines were pulled up in exact proportion to the reduction of speed. The revolutions of the propellers, without any barge in tow, were 210 per minute; with a 60-tons loaded barge, reduced to 180; with two barges, to 160 revolutions per minute.

The question of the pitch of the screw appears hitherto to have baffled all those who have experimented upon it; the ordinary theory being, that an increasing of the screw's pitch should either pull up the engines, or increase the speed of vessel in proportion to such increase of pitch, which all the practice hitherto has proved *not to be the case*, and consequently the screws have been made without any power of altering the pitch, to meet the variations of winds and currents to which all sea-going vessels are subject, and they have been thus deprived of what would appear the most valuable feature of the screw, viz., its power of adapting its pitch to meet every contingency. On reference to the tables of experiments, it will be seen that with the new propeller the engineer can control the speed of his engines at pleasure, by increasing or diminishing the pitch of the blades, so that, in a fair wind, the full power of the engines may be exerted in effectively propelling the vessel, instead of consuming fuel in driving round the engines (with a fine pitched screw) to no purpose, and again, in going head to wind, by diminishing the pitch, the engines can be made to give out their utmost duty with a certainty of effectually propelling the vessel. The large central ball affords the opportunity of constructing a most simple and effective arrangement for altering the pitch of the blades, and feathering them parallel to the shaft when not required for propelling. The captain or engineer of the vessel can alter the pitch at pleasure, without even stopping the engines, the speed of which is, by means of this apparatus, as completely under control as with a throttle valve.

A most serious disadvantage, hitherto, of the screw as a propeller, compared to the paddle-wheel, has been the great difficulty of going astern, and many serious accidents have happened to screw vessels in crowded navigations from it being out of the power of the captains, when in difficulty, to go quickly astern. So soon as stern way is obtained, screw vessels will not steer, and become unmanageable. During the experiments in the *Ranger*, with Griffiths' propeller, the vessel was frequently stopped, when at full speed, the engines reversed, and the vessel brought quickly astern nearly as quickly as a paddle vessel, and a run was made above a mile astern, full speed, between Woolwich and Erith, steering among the various craft as easily as when going ahead. This fact gives further convincing proof of the complete power which this propeller gives the captain over his vessel. This power of going astern will be of enormous value to vessels of war in manœuvring in an engagement, which they do not now possess.

It will be seen, by the accompanying table of trials made upon the *Eagle*, that as the pitch was increased, so was the engine brought up in her speed. The comparative slip between the new screw and the old one, at same pitch, 7·6, is 272 yards per mile with the former, against 665 yards with the latter; the gain with the same pitch being an increased speed of $\frac{1}{4}$ mile, with 27 revolutions per minute less of the engines, making 16 per cent. less consumption of power and coals. At the 9 ft. 6 in., the increased speed is $\frac{3}{4}$ths of a mile per hour, with 35 revolutions per minute less of engine, making a saving of 22 per cent. The table also contains trials of the *Ranger*, 300 tons, in London, and the *Weaver*, at Liverpool, the whole of the experiments illustrating the foregoing arguments.

GEORGE HINTON BOVILL.

19, Abchurch Lane,
London, 29*th June*, 1852.

TABLES SHOWING THE RESULTS OF SEVERAL TRIALS OF GRIFFITHS' PATENT PROPELLER, AND THEIR COMPARISON WITH THE ORDINARY PROPELLER.

Revolutions of Engine.	Revolutions of Screw.	Steam in lbs. above Atmosphere.	Vacuum in Inches.	Time occupied in Running the Measured Nautical Mile.	Knots per Hour.	Statute Miles per Hour.	Diameter of Screw.	Pitch of Screw.	Angle of Screw with Plane of Motion.	Speed forward per hour of Propeller in Statute Miles.	Difference in Statute Miles between Speed of Screw and Speed of Vessel per Hour.	Per Centage the Slip bears to the whole Speed of Screw.	Number of Revolutions made by Engines running a Nautical Mile.	Per centage of saving in Revolutions of Engine, and therefore in Power.	Gain per cent. in Speed.	
																TRIAL OF THE *EAGLE* AT BRISTOL, *June*, 1851. Single Engine, high pressure, cylinder 26 inches diam., stroke 1 ft. 6 in. direct action. Vessel and engine by Lunell and Co., Bristol.
200	200	38	..	m. s. 5·34	10·77	12·36	ft. in. 4·10$\frac{1}{2}$	ft. in. 7·6	26$\frac{1}{2}$	17·0	4·67	27$\frac{4}{10}$	1113			Average of several pairs of runs with common propeller.
195	195	35	..	4·59	12·04	13·8	..	6·6	23$\frac{1}{2}$	14·40	·59	4$\frac{1}{10}$	971	12$\frac{3}{4}$	11$\frac{3}{4}$	Average of 1st pair of runs with Patent Propeller.
173	173	37	..	5·23	11·14	12·79	..	7·6	26$\frac{1}{2}$	14·74	1·95	13$\frac{3}{10}$	931	16$\frac{3}{10}$	3$\frac{1}{2}$	Average of 2nd do. do.
171	171	34	..	5·25	11·07	12·70	..	8·6	29$\frac{1}{2}$	16·51	3·81	23	926	16$\frac{8}{10}$	2$\frac{3}{4}$	Average of 3rd do. do.
165	165	35	..	5·15	11·42	13·125	..	9·6	32$\frac{1}{4}$	17·8	4·675	26$\frac{2}{10}$	866	22$\frac{2}{10}$	6$\frac{1}{8}$	Average of 4th do. do. The Patent Propeller was made 4ft. 2in. diameter, but the opening in the vessel having been increased during construction to 5ft., the Propeller was enlarged in diameter by welding pieces on the points of the blades, which were thereby thrown out of their proportionate size.
																TRIAL OF THE *RANGER* AT LONG REACH, 8*th December*, 1851. Pair of condensing engines, cylinders 27 inches diam., stroke 2 feet, screw worked by gear 106 to 40. Vessel and engines by Miller and Ravenhill.
54	143	12	24	5·8	11·688	13·447	6·2	6·8	19	..	..	..	..	..	..	1st run down with tide, Patent Propeller.
50	132	..	..	11·14	5·341	6·145	6·2	6·8	19	..	..	..	..	..	..	2nd run up against tide, do. { Showing against tide a reduction of 4 revolutions per minute of engines, with same pitch of screw.
52	137$\frac{1}{2}$	12	24	..	8·514	9·796	6·2	6·8	19	10·42	·624	6	..	..	..	Average of 1st pair of runs, do. { The pitch was subsequently reduced to 5ft. 2in. when running against tide, which allowed the engines to get up to 70 revolutions per minute, by which a speed of 6·909 knots per hour, against tide, was obtained, and which, added to the run down with tide at 6ft. 8in. pitch, gives an average of 9·298 knots per hour.
44	116$\frac{1}{2}$	10	24$\frac{1}{2}$	6·36	9·09	10·45	5·10	10.0	2·8$\frac{1}{2}$	13·23	2·78	21	270	36	6$\frac{8}{10}$	Single run at top of tide with Patent Propeller at coarsest pitch. Owing to the *Ranger* being employed on a station from which it was impossible to spare her for the purposes of experiment, there has been no opportunity of making a proper set of trials to compare her ordinary screw with the Patent Propeller; but we have taken her speed at the measured mile, when going out with a cargo, and with a 40 minutes ebb tide and wind in her favour; and this run is put into comparison with our single run as above.
60	159	12	27	7·3	8·51	9·76	7·0	6·10	17$\frac{3}{4}$	12·33	2·57	20·8	423	..	..	Single run with 40 minutes ebb and wind in favour, with common propeller, referred to in note above.
																TRIAL OF THE *WEAVER* AT LIVERPOOL. Vessel by John Laird, Birkenhead; Engines by Fawcett, Preston & Co., pair of condensing engines, cylinders 22 inches diam., stroke 1 ft. 3 in., work screw by gear of 4 to 1.
83	332	11	28	6·2	9·94	11·40	3·3	4·6	24	16·97	5·40	32	500	..	..	11th June, 1852.—Average of pair of runs with common propeller, from Woodside-pier to Eastham-pier, 5$\frac{3}{4}$ statute miles.
65	260	11	28	5·37	10·7	12·28	3·3	4·6	24	13·29	1·01	8	365	27	7$\frac{6}{10}$	18th June, 1852.—Average of pair of runs with Patent Propeller, from Woodside-pier to Eastham-pier, same state of tide as trial with common screw in the preceding week, but wind strong and unfavourable, and a heavy sea.

19th June, 1852.—A run with the Patent Propeller set at 5 ft. 2 in. pitch was made in the Mersey from the Duke's Dock at Liverpool up to Weston Point; the distance by the direct course, which can only be taken at high water, is 14 miles, but by the navigable channel, followed by the *Weaver*, is 16 miles. Left Liverpool at 10 a.m. (high water at 12·30); had a tide in favour, estimated at about 3 miles per hour; arrived at 10·55=55 minutes, average pressure of steam, 10lbs. vacuum, 28 inches. Revolutions of engines, 62.

NOTES BY A PRACTICAL CHEMIST.

Estimation of the Free Acids in the Juices of Fruits.—M. Graeger mixes the juices under examination with neutral tartrate of potassa, and calculates the amount of free acid from the quantity of bitartrate which separates. To determine the amount of free tartaric acid in a juice, a second portion is divided into two equal parts; the one is neutralised by potassa, and the other half of the juice now added, and the amount of acid calculated from the quantity of precipitated bitartrate of potassa.

Colouring Matter of Saffron.—M. Quadrat prepares the colouring matter of saffron as follows:—The saffron is exhausted with ether, and then extracted with boiling water; the clear aqueous solution is precipitated with basic acetate of lead; the red precipitate which forms is washed in water; suspended in water; and then decomposed by a current of sulphuretted hydrogen, and well washed. The colouring matter is then extracted from the precipitate by boiling alcohol, the alcoholic solution evaporated to dryness in the water-bath; the residue treated with water, and the aqueous solution evaporated to dryness. The colouring matter forms an aurora-red, inodorous powder, which dissolves in water with a yellow colour. A trace of alkali increases its solubility in a high degree. It is freely soluble in alcohol, sparingly in ether. It is decomposed by strong mineral acids and concentrated alkalies. Its formula is $C^{20} H^{13} O^{11}$. With salts of copper it gives a green, with lime or baryta-water, a yellow, precipitate.

On the Sulphur in Cast Irons.—M. Janoyer, after a variety of experiments, has come to the conclusion that, in order to obtain a metal as free as possible from sulphur, it is necessary that the slags should contain the maximum amount of lime. The working of the furnace should be as hot as possible, in order to facilitate the isolation of the graphite, and consequently the formation of the sulphuret, of carbon, which serves to transfer the sulphur from the metal to the slag. A considerable improvement has recently been effected in the working of blast furnaces, by washing the coals, which removes a great portion of the pyrites, and also by getting rid of the earthy matters, increases the heating power of the coal.

On Dyeing with Sandal-wood.—In order to dye as fine a red with sandal-wood as with madder, M. Wimmer first exhausts the wood with boiling water. He then treats it with a cold filtered solution of chloride of lime as long as this becomes coloured, and washes it perfectly with pure water. From the wood thus prepared, the red colouring matter is extracted by a hot, but not boiling, solution of soda, the wood being tied up in a linen bag, and the kettle covered with a well-fitting lid. The extract should have a deep red colour, inclining to violet. Cottons, linens, and woollens are prepared with acid mordants, and dyed in the usual manner. The author obtained a beautiful scarlet by treating the stuffs alternately with a mordant of chloride of zinc, and the above bath. The colours are durable and particularly useful in saving cochineal, as stuffs which are to be dyed with the latter may previously receive a ground of sandal-wood.

Process for Detection of Fluorine in presence of Silica.—This process depends on the principle, that when a fluoride, combined or mixed with silica, is treated with oil of vitriol, the fluorine and silicon are evolved in combination as fluoride of silicon. It is applicable to all silicated fluorides which yield this gas. It applies also to compounds containing mere traces of fluorides, but free from silica, which are brought within the compass of the process by the addition of silica, so as to admit of their being treated in large quantity with oil of vitriol in glass vessels. The fluoride of silicon set free, in either case, is conveyed by a bent tube into water. The resulting solution, containing some gelatinous silica, is super-saturated with ammonia and evaporated to dryness, during which process the fluoride of silicon and ammonia is resolved into insoluble silica and fluoride of ammonium, which is dissolved out by digesting water on the evaporated residue. The solution is then evaporated to dryness and heated with oil of vitriol in a platinum crucible covered by a piece of waxed glass.

Detection of Minute Traces of Copper.—Mr. R. Warrington adds ferrocyanide of potassium to the solution to be tested, to which excess of ammonia has previously been added. The ferrocyanide of copper is held in solution by the ammonia, and is afterwards deposited from the filtrate as the ammonia is allowed to evaporate.

ANSWERS TO CORRESPONDENTS.

"F. M."—We do not think that any printed instructions without the aid of a practical man would qualify you to commence the manufacture of fire-works. It is, you will remember, a dangerous business, and one where the object attained scarcely warrants that danger.

"Norwich."—Sir H. Davy made various attempts to decompose some of the bodies we generally consider as elementary; but without any decisive result. S.

THE YORKSHIRE UNION OF MECHANICS' INSTITUTES.

The Annual meeting of this important Union of Mechanics' Institutes took place at Skipton on the 2nd instant, Edward Baines, Esq., the president, in the chair. The chairman congratulated the delegates and others present, on the arrival of their fifteenth anniversary. They now represented 124 institutions in the county of York, numbering collectively 20,000 members. We regret that we can only find room for the heads of the proceedings.

Mr. Hole then read an elaborate report, which entered fully into a variety of matters connected with the past working, the design, and the influence of the Mechanics' Institutes of Yorkshire. The following are the introductory and statistical facts given in the report:—

The Committee of the Yorkshire Union of Mechanics' Institutes, on this, the fifteenth annual meeting of the Union, have great pleasure in reporting the general continued welfare of the Yorkshire Institutes. In the income, the number of books in the libraries, and the circulation of those books—all important signs of success—there has been a gratifying increase. On the other hand, in an element of prosperity at least as important as any—the number participating in those benefits, the increase has been very small. The following table will show the aggregate condition of the Yorkshire Union:—

	1851.	1852.	Increase.
Total number of institutes in the Union	117	124	7
Total number in 94 institutes Ditto estimated from last year's report in 16 do.		19,043	
(13 institutes without reports or estimates)			
Total income of 103 institutes	..	£8,452	..
Number of volumes reported in libraries of 113 institutes, for 1852	..	95,529	..
Circulation of books in 113 institutes	..	388,202	..
Number of books added during the past year to the libraries of 113 institutes	..	6,667	..
Returns from 73 institutions, of periodicals — weekly 188, monthly 539, quarterly 68, newspapers 416	..		..
Number of paid lectures in 35 institutes	..	144	..
Ditto unpaid do. in 70 do.	..	463	..

The next table will show the comparative progress made during the past year:—

Designation.	1851.	1852.	Increase.	
			Nos.	Per cent.
Males in 79 institutes	14,181	14,429	348	2·4
Females in 60 do.	1,327	1,452	125	9·4
Income of 75 do.	£6,814	£7,195	£381	5·6
Books in 79 do.	72,722	78,357	5,635	7·7
Issues in 75 do.	309,316	327,548	18,232	5·9
			Decrease.	
Lectures in 75 do.	644	617	27	4·2

The comparatively small increase in numbers made during the past year, compared with the increase in the previous year, may be in part attributable to the attractions of the Great Exhibition, as alleged in one or two of the reports. It is to be feared, however, that it is more owing to the want of adequate encouragement and support on the part of those for whose benefit these institutions exist. Very much remains to be done in rendering the institutes better known and more useful.

During the past year, your agent and lecturer, Mr. T. J. Pearsall, has paid 131 visits to the institutes, of which there were—

Lectures	56
Soirées, &c.	28
Conferences with Committees, &c.	47
	131

In addition to the above, lectures were arranged for with nine institutes, but not delivered, owing to a change of dates ; nine institutes declined receiving visits or lectures, and nine never replied at all, although, in some instances, circulars were sent three or four times. From the impossibility of arranging his engagements, much time has been lost to your agent, and a considerable increase in his travelling expenses has been incurred through neglect of this description—a neglect to be regretted not only on this account, but also as indicating a want of punctual business habits, that primary condition of the success of our institutes. Several of the reports name the advantages they have derived from Mr. Pearsall's visits, and your committee hope that he will continue to use his best exertions to render his visits useful and acceptable to the institutes.

The report next noticed the very important subject of investing the institutes with efficient powers of self-regulation and security of property ; pointing out that the difficulties in the way of doing this by a trust deed were very serious, these difficulties applying in a measure to buildings and fixed property, but in a much greater degree to books and moveable property. These difficulties appeared to the committee so great as to render further advice necessary, and they accordingly consulted Robert Hall, Esq., the recorder of Doncaster, who concludes an elaborate opinion on the whole subject by the following sentence:—"I consider that the assistance of the legislature is necessary to secure any approximation to uniformity of organisation, and, at least as regards most existing institutions, to have the power of suing or prosecuting members, and to give power of self-regulation and modification on many points, such as the ultimate application of the fund, without having recourse to the Court of Chancery." Under these circumstances, the committee believe an application to the legislature to be the only safe and prudent course, the object being to secure for these institutions better means of self-government and self-protection than they at present possess.

Reference was made to the conference of delegates of Mechanics' Institutes, lately held in London at the Society of Arts, and hopes were entertained that good would result from it in various ways, at the same time that the independence of the institutes should be preserved. Difficulties were not overlooked, and caution in proceeding was recommended. The report further stated, that a new edition of a catalogue of books suitable for Mechanics' Institutes, is being arranged by Mr. Traice, of Leeds, who is peculiarly qualified for the task. As to lectures, there had been such a paucity of engagements offered to paid lecturers, that the committee had discontinued the plan of sending out half-yearly lists, but it stated that gentlemen had been applied to, to form a literary corps for their respective neighbourhoods, professional men being particularly qualified to engage in such a work, as well as all who had a favourite object of study. The report then noticed the recreation department as a desirable adjunct to Mechanics' Institutes in a subordinate sphere ; the encouragement of more social intercourse, music, and similar resources, were strongly recommended as proper and genial to introduce into the more serious pursuits of the institutes. Good business arrangements, in all matters pertaining to the institutions, were strongly recommended. The rates of subscriptions of members of institutes during the summer was another topic referred to, the position of the societies being comparatively weak when the subscriptions were continuous through the year, but were still worse when intermitted. Visiting of members was instanced as very efficacious in some districts. Preliminary savings' banks were mentioned as increasing. Garden allotments were recommended as useful, but might prove to attract from the proper work of an educational institution. The erection of a new Mechanics' Institute at Gomersal, at a cost of £2,000, was noticed with great commendation. After referring to several other topics of interest, the report concluded with a strong recommendation of the objects of educational societies, such as Mechanics' Institutes, as tending to instruct and elevate all classes.

The report having been received and adopted, it was moved and seconded, and carried unanimously—

"That in the opinion of this meeting the existing law does not adequately secure the property of Mechanics' Institutions, or afford means of carrying their rules for self-government into effect, in so simple and inexpensive a manner as the nature of such institutions renders necessary.

"That it appears to this meeting highly desirable that Mechanics' Institutions throughout the kingdom should unite in an early application to Parliament for an act to secure the property and enforce the rules of such institutions, and that the Central Committee of this Union be requested to invite the co-operation of the other institutions of the kingdom in application to Parliament for that purpose, and, in behalf of this Union, to join any other institutions in making and proceeding with an application to Parliament accordingly."

The next resolution was in accordance with numerous petitions which have been presented to Parliament—

"That it is most desirable that Mechanics' Institutions should become depositories of collections of the valuable reports and papers printed from time to time by order of the House of Commons, and that the institutions of Yorkshire be recommended to petition for the presentation of such reports and papers, free of all pecuniary charge."

Mr. T. Wilson, of Leeds, introduced the next resolution, referring to the proposed connection of Mechanics' Institutes with the Society of Arts. From the reports given in the public papers of the meeting held in London under the auspices of the Society of Arts, the object was to form some central body which might act upon, and be acted upon by, the Mechanics' Institutions. This was what was done in the Lyceum system in America. The subject was not a new one, for when the Union met at Bradford, a committee was appointed to consider it, but he was sorry it produced no fruit then. He had read the proceedings of the recent meetings in London, and regretted to find that the resolutions were so general in their nature; there was nothing practical which could lead them to see what were the views of the parties at the head of the movement, or whether they understood the wants of the parties they wished to benefit. If they had not the necessary information, he hoped they would call to their councils those who had the management of these institutions, and the result would be beneficial in promoting the object they had at heart. In conclusion, he moved a resolution, stating that the meeting regarded the movement in London with interest, and recommended it to the careful attention of the committee, but deemed it in the highest degree desirable to maintain the Yorkshire Union in full efficiency (cheers).

Mr. Norman, of Ripon, in seconding the resolution, said he had for some years been of opinion that some such association in London was necessary to act on the country institutions. He thought the Society of Arts, of all others, the most likely to bring their efforts to bear in this matter. They wanted to act on the public mind, and there wanted some focus or instrumentality by which their objects could be carried out. It was a matter of regret that a more definite plan had not been marked out, but he understood from Mr. Williamson, of Ripon, that there were some impediments in the way of work-

ing out the objects they had in view. Many of the institutions were too poor to pay the annual contribution required, but he hoped the committee would be able to suggest some plan by which this proposed central organisation could be carried out. Perhaps the better way would be for the local unions to be the medium of communication with the central authority, leaving the county institutions to pay their contributions into their own local union (hear, hear).

The chairman said, having, on behalf of the Yorkshire Union, attended the meeting in London, he could assure them that nothing could be more gratifying than the tone and temper of that meeting. Men of all parties, and of the highest influence and attainments, were there, and both the Marquis of Lansdowne, who presided, and Mr. Harry Chester, in the most decided manner, expressed a wish that nothing should be done to interfere in any way with the independent action of Mechanics' Institutions (hear, hear). The object the Society of Arts had in view was very much what the Yorkshire Union had in view—to cheapen lectures to all Mechanics' Institutes; and to do this by a geographical and chronological plan, so that the expenses might be reduced to the smallest amount. But they were aware what great difficulty the Union had experienced in the practical working out of their plan; and, as regarded professional lecturers, they had found it a failure. He wished the Society of Arts might succeed in their object. After pointing out several reasons which made him doubt the success of the effort—such as the want of taste for scientific lectures, the poverty of many of the institutions, &c., the chairman said, the larger institutions, such as those at Leeds, Manchester, and Bristol, might contribute, and thus connect themselves with the society, and the smaller institutions might be benefited by the cheapening of scientific works, such as producing a copy of Euclid for 1s. In boxes of colours and mathematical instruments, the society has done this. As, however, the plan of the society was not yet mature, they might, in the words of the resolution, remit this matter to the committee.

A dinner and soirée followed, at the latter of which Sir Charles Wood took the chair. The following resolutions were passed, after admirable speeches from the leading men present:—

"That the mechanical and chemical processes so largely employed not only in the arts but in agriculture also, render an acquaintance with the principles of these sciences necessary alike to the manufacturing labourer and the husbandman, and that due provision for their teaching should be made in all educational institutions intended for the benefit of those classes.

"That a great portion of the working classes are either imperfectly educated, or without the means, at their own homes, of maintaining and extending the knowledge they may have acquired, and that Mechanics' Institutions are eminently qualified by their elementry classes to provide instruction for the former, and by their lectures and libraries to supply ample stores of information for the latter.

"That the power of perceiving, and the skill to produce, beauty of form and harmony of colour, are not only necessary to the successful discharge of the duties of the artizan and decorative manufacturer, but powerfully tend to elevate and to refine the mind, and that no education which overlooks so important a department can be adequate to the wants of the great body of the people."

EASTERN STEAM NAVIGATION COMPANY.

An adjourned extraordinary general meeting of this company was held on the 12th instant, Mr. G. T. Braine in the chair. The Secretary, Mr. Yates, read the report, of which the following is an abstract:—

The objections discovered, on examination of these plans, led the way to the consideration of a third plan, submitted to your directors, which should comprise the elements of high speed without the inconvenience and great expense inevitably attending the overland route. It was suggested to your directors, that steam-vessels of the great power which modern science renders attainable, might be despatched by way of the Cape, so as to accomplish the distance between England and Calcutta in the same or less time than the present transit by Southampton and the Desert, and with great increase of comfort and economy to the passengers. For this purpose, it would only be necessary that vessels should be employed possessing the speed of 15 or 16 knots an hour. It appeared that 15 knots an hour would accomplish the distance to Calcutta in 32 days, 16 knots in 30 days, and 17 knots in 28 days. Vessels of this class could therefore be prudently calculated on to perform the entire distance in 30 to 32 days, provided only they were not obliged to stop and coal by the way. The next question was, whether a vessel could be constructed of power and capacity to perform the voyage to Calcutta without stopping to coal by the way. On this point the whole question hinged. The power of carrying coal for the whole voyage involves the difference of 12s. to 13s. per ton in comparison with a cost of 40s. to 45s. per ton; which latter is the average of the cost of coal per ton throughout the overland route. The consumption of coal is known to be the great element of cost in steam navigation; and if this could be reduced by two-thirds, it was obvious that great corresponding increase of speed and power might be obtained not only at no increase, but at an actual diminution of expense.

In accomplishing this object, increased size in the vessel was a necessary ingredient, and with it an ability to provide accommodation for passengers and goods of the description alluded to. It is a principle in ship-building now ascertained, that in proportion as the vessel is increased in size, her disposable capacity for passengers and cargo increases in a higher ratio; thus, a vessel which could carry her coals for the voyage to Calcutta would necessarily possess the capacity to convey a largely-increased number of passengers and a large quantity of measurement goods. It is equally matter of experience, that the speed attainable by large vessels is greater in proportion to their power than with smaller vessels; it was clear, therefore, that such a means of communication must possess immense advantage over any other hitherto existing, in its extent of accommodation, comfort, and cheapness. On these points your directors consulted the highest engineering authority. Of all the eminent engineers in this country, Mr. Brunel is known to have dedicated the most time and attention to the improvement of ocean steam navigation, and the construction of vessels for that purpose. The "Great Western," the first vessel which was built expressly to carry her own coal from England to America, owed her existence to him; and the present scheme is only a development of the same principle. Mr. Brunel has satisfied your directors of the practicability of building and running such vessels with advantage, and his views are borne out by the opinions of other eminent engineers and ship-builders. The mechanical difficulties being thus solved, the question remained for the consideration of your directors, whether passengers and freight existed in a sufficient number and quantity to make the employment of such vessels a matter of profit. On this point (possessing among themselves considerable knowledge and extensive experience of the trade with India) your directors had less difficulty in arriving at a conclusion. After deliberation and inquiry, they are satisfied that vessels of the class referred to, making one voyage out and home every two months, would find a sufficient amount of passengers and manufactured goods to yield a very large return, and that that return would be subject to fewer contingencies and less drawbacks than in the case of vessels running under contract, as to their structure, and as to the time of departure and arrival. In their calculations on these points, your directors have estimated freight at that now paid to sailing-vessels, and passage-money at about half the cost now paid by the overland route, while they have allowed for the passengers luxurions and roomy cabins, with air and comfort, and accommodation on a scale hitherto wholly unattainable. For these arrangements, about one-half of the total capital will be required, and there will be ample provision for the future extension of the operations of the Company. Upon a mature consideration of the whole subject, your directors have come to the conclusion of recommending to you to proceed with the proposed plan of building steam-vessels capable of effecting the views above expressed on the principle of carrying their own coal for their voyage to Calcutta. Your directors have to express their regret at the retirement of their chairman, R. W. Crawford, Esq., and of Joseph Edmann, Esq., Robert Brooks, Esq., Thomas Holroyd, Esq., and John Scott, Esq. Your directors are, however, able to add, that the retirement of these gentlemen proceeds from personal considerations. The names of the undermentioned gentlemen will be proposed to you to fill up the places of those directors who have retired; and it will also be a part of the duty of your directors to recommend to you to increase the number of directors, under the powers contained in the deed of settlement for that purpose, from twelve to eighteen: Henry Thomas Hope, Esq., M.P., of 116, Piccadilly; Christopher Rice Mansel Talbot, Esq., M.P., of 3, Cavendish-square; Philip William Skynner Miles, Esq., M.P., of 44, Belgrave-square; Samuel Baker, Esq., of 147, Leadenhall-street; Richard Potter, Esq., of Gloucester.

The directors remaining are—the Hon. F. H. F. Berkeley, M.P.; George Thomas Braine, Esq.; James St. George Burke, Esq.; Robert James Roy Campbell, Esq.; Harry George Gordon, Esq.; William Henry Goschen, Esq.; John Edward Stephens, Esq.

The new contract with the P. and O. Company still leaves the communication with India imperfect. The time to Calcutta will be at least 35 days; the vessels are crowded, and have no means of carrying light manufactured goods and parcels, which are offered, although the rates are almost probibitory. The line which the directors originally proposed, *viâ* Trieste, appeared ineligible without a government subsidy, as it is merely a competing line with the P. and O. Company, and a line *viâ* the Cape, if with ordinary vessels, would be merely a duplicate of that of the General Screw Company.

In reply to questions, Mr. Brunel stated, that it was not intended to have any coaling station, unless under extraordinary circumstances, as the high price of freight or other special reasons should render it necessary. One main feature of the plan was to purchase the coal at the low price at which it could be had only in this country, and that each vessel should carry sufficient for the whole voyage. He had no doubt that a speed of 15 knots as the lowest average might be maintained. The vessels it was proposed to build would be constructed principally of iron. Of course every known improvement would be adopted in the machinery. They would be very large, and would carry probably 3,000 to 4,000 tons of coal each, besides having ample stowage for cargo and the most extensive accommodation for passengers. They would be propelled by paddles and the screw together, which would give them the power of three distinct and separate engines, and thus provide for all contingencies.

Mr. Scott Russell remarked that there were steam-vessels now doing 18 miles an hour regularly, and instanced the Holyhead boats, and it was well known amongst ship-builders now that it was much easier to get a high rate of speed in large than in small vessels. Length meant speed—and not only that, but speed and cargo room, and easy-going combined. The old rule of ship-building was 3 beams for the length, they then increased them to 4 and 5, and the American clippers were merely the old English and American ships built rather sharper and in the proportion of 6 beams to the length. He had built a small vessel in the proportion of 12 beams to the length, which had made 18½ miles an hour in still water, and in a voyage to Hamburgh and back, in very rough weather, had not shipped a drop of water, and had gone so easy through the sea that no one was ill on board, though several were subject to sea-sickness. He did not mean to recommend that proportion for the Calcutta vessels, but what he recommended was, that they should be long enough to secure speed, capacity, and ease, and to carry sufficient coal without interfering with the other requirements.

Resolutions were passed, authorising the board to carry out this scheme, Mr. Martin remarking that the company had already done the state some service by saving them £70,000 per annum on the existing India mails. Mr. Crawford, the late chairman, stated that their arrangement with the Austrian Lloyd's would, in all probability, have been carried out, had not one of their own proprietors, who was in the confidence of the directors, gone behind their backs and opened a negotiation between the Austrian Lloyd's and Peninsular and Oriental.

SHIPBUILDING ON THE CLYDE.

GLASGOW, 1852.

MESSRS. ROBERT BARCLAY AND CURLE, SHIPBUILDERS, FINNIESTON,

Launched from their building-yard, on the 9th of February, the (timber) sailing-ship, *City of Edinburgh*, for the Glasgow and Calcutta monthly line of packet-ships, owned by Messrs. George Smith and Sons, merchants, Glasgow. Classed 13 years, A 1; flush on deck; full female figure-head; launching draft of water, forward 7 feet 3 inches, and 9 feet 8 inches aft.

Dimensions.	ft.	tenths.
Length on deck	139	0
Breadth on do., amidships	26	1
Depth of hold, do.	20	1
Tonnage.	Tons.	
Register	$598\frac{58}{100}$	
Do. (Act for foreign vessels) ..	$560\frac{121}{130}$	

They launched, on the 9th of March, the iron sloop, *Hunter* (of Greenock), for the coasting trade, round-sterned and clinch-built vessel; frames, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$ inches, and 18 inches apart; stem, $4\frac{1}{4} \times \frac{7}{8}$ inches; keel and stern-post, $4 \times \frac{7}{8}$ inches; light draft of water (mean), 2 feet 10 inches; loaded with 75 tons of cargo, 6 feet 6 inches forward, and 7 feet aft.

Dimensions.	ft.	tenths.
Length on deck	56	7
Breadth on do., amidships	15	1
Depth of hold, do.	6	1
Tonnage.	Tons.	
Register	$43\frac{27}{100}$	

They also launched, on the 1st of May, a beautiful clipper-built ship, *Jacatra* (of Glasgow). Flush on deck; classed 13 years, A 1; with a full male figure-head; owned by Duncan M'Gregor, Esq., and the commander of the vessel, Captain Thomas Aiton; to be employed in the Clyde and Java trade; sailed in the end of June for Batavia and Sourabaya.

Dimensions.	ft.	tenths.
Length on deck	121	5
Breadth on do., amidships	22	9
Depth of hold, do.	16	5
Tonnage	$348\frac{13}{100}$ tons.	

They have upon the stocks, and in frame, a timber-ship, to class 13 years, A 1. Flush on deck; for the Glasgow and Calcutta monthly line of packets (same owners as the *City of Edinburgh*) and will be named the *City of Benares*.

Dimensions.	ft.	in.
Length of keel and fore-rake	162	0
Breadth of beam	30	0
Depth of hold	21	0
Tonnage	$703\frac{68}{94}$ tons.	

CESSNOCK-BANK (GLASGOW).

Messrs. James and George Thomson, engineers and iron ship-builders, launched from their building-yard, on the 19th of March, an iron paddle-wheel steam-tender, named the *Jackal*, the property of the British and North American Royal Mail Steam Navigation Company, built with the double bow, having Mr. John Laird's patent double rudder, &c.; is fitted by the builders with one tubular boiler, and registers 111 tons (exclusive of the engine-room); having 2 masts; 1 deck. Sailed from Glasgow for Liverpool on the 14th of April, under the command of Mr. Archibald White, where the engines, &c., are to be received and put on board.

On the 1st of May was launched an iron paddle-wheel steamer, named the *Venus*, the property of the Large Steamboat Company, having 1 steeple-engine and 2 tubular boilers, and 2 funnels. Has capital accommodation for passengers. Commenced to ply in June; trial-trip, 17th of June; sails fast.

On the 29th of May there was launched the iron paddle-wheel steamer, *Mountaineer*, the property of the West Highland Steam Navigation Company; is a beautiful model, and fitted by the builders with 1 steeple-engine and 2 tubular boilers, and 2 funnels; and is also fitted with Morgan's patent feathering paddle-wheels, and is tastefully fitted up for passengers. She is plying as consort to *Pioneer*, between Glasgow and Ardrishaig. These are the first three vessels launched by the firm since they commenced building for themselves.

They have also upon the stocks, ready to launch, a paddle-wheel steamer, a large screw-steamer in frame, also the keels of two other screw-steamers laid down.

KELVIN-HAUGH.

Messrs. Alexander Stephen and Sons, shipbuilders, have on the stocks a ship (building under a shed), to class 14 years, A 1, having a poop, 56 feet long and 6 feet 6 inches in height, with a top-gallant forecastle; nearly ready to launch; intended for the East Indies, China, or Australian trades.

Dimensions.	ft.	in.
Length of keel and fore-rake	155	0
Breadth of beam (extreme)	30	0
Depth of hold	19	0
Tonnage, O.M.	$655\frac{80}{94}$ tons.	
Do., N.M., about	700 ,,	

Will carry about 900 tons dead weight of cargo.

Also upon the stocks, and plated, an iron clipper-ship for the Clyde and Australian trade; owners, Messrs. Potter, Wilson, and Co., merchants, Glasgow; has a round stern; will carry about 2,000 tons measurement goods, or about 1,400 tons dead weight; having a poop and top-gallant forecastle, and is to be named the *Typhoon*.

Dimensions.	ft.	in.
Length of keel and fore-rake	198	5
Breadth of beam	32	0
Depth of hold	20	0
Length of poop, about	76	0
Tonnage, O.M.	$976\frac{6}{94}$ tons.	
Do., N.M., about	1,100 ,,	

Stem tapering from 10 inches, at keel, to 7 inches at deck × 3 inches; stern-post, 10 × 4 inches; keel, 9 × 3 inches; plates of keel, $\frac{13}{16}$th of an inch; ditto at gunwale, $\frac{5}{8}$ of an inch; frames, 5 × 3 × $\frac{5}{8}$ inches, and 15 inches apart. She will be fitted up with every improvement for the accommodation of passengers.

GOVAN, 1852.

Mr. Robert Napier, engineer and iron ship-builder, launched from his building-yard, in February, a beautiful iron sailing-brig, flush on deck, having a round stern, and clinch-built; clipper bow; a shield figure-head; for the West India trade; will carry about 280·34 tons of cargo; is owned by John Young, Esq., merchant, Glasgow.

Dimensions.	ft.	tenths.
Length on deck	100	6
Breadth on do., amidships	21	0
Depth of hold, do.	12	4
Tonnage	$183\frac{2}{100}$ tons.	

There was also launched from this yard, on the 7th of May, a beautiful iron pleasure-yacht, fully rigged, the property of the builder.

They have also in frame two screw-steamers.

FAIRLIE.

Messrs. Fyfe and Sons launched the present year a very beautifully-modelled pleasure-yacht, named the *Walrus* (of Dublin), rigged 2-masted schooner, owned by E. J. Buller, Esq., of Belvadare, Dublin.

Dimensions.	ft.	tenths.
Length on deck	41	7
Breadth on do., amidships	11	3
Depth of hold, do.	6	8
Tonnage.	Tons.	
Register	$18\frac{76}{100}$	

DUMBARTON.

Messrs. Denny and Rankin, shipbuilders, launched from their yard the ship *St. Lawrence*, for the Liverpool and Montreal trade. The property of Messrs. James and Alexander Allan, merchants, Glasgow. Has a full female figure-head; flush on deck, with round-house.

Dimensions.	ft.	tenths.
Length on deck..	133	5
Breadth on do., amidships	26	4
Depth of hold, do.	19	3
Tonnage.	Tons.	
Register..	$578\frac{20}{100}$	

Will carry about 794 tons of cargo.

CARTSDYKE (GREENOCK).

Messrs. William Simons and Co. have launched from their building-yard a very handsomely-modelled ship, named the *William Connall*, for the Glasgow and Calcutta monthly line of packet ships, having a bust male figure head; flush on deck, classed 13 years, A 1.

Dimensions.	ft.	tenths.
Length on deck..	148	3
Breadth on do., amidships	26	$3\frac{1}{2}$
Depth of hold, do.	19	5
Tonnage.	Tons.	
Register..	$596\frac{17}{100}$	

Sailed for Calcutta from Glasgow, April 20th.

Also, from their yard this year, the barque *Innellan* (of Greenock), for the Clyde, Ceylon, and Madras trade; classed 8 years; owned by Messrs. M'Millan and others; commander, Mr. Clark. A bust female figure head; flush on deck.

Dimensions.	ft.	tenths.
Length on deck..	97	0
Breadth on do., amidships	22	8
Depth of hold, do.	16	6
Tonnage.	Tons.	
Register..	$287\frac{67}{100}$	

These will be the last two sailing vessels built by this firm in this place, they having taken a building-yard at White Inch (Glasgow), for the purpose of building both iron and timber vessels.

THE NEW IRON STEAMER, "GLASGOW CITIZEN."

Built and fitted by Mr. John Barr, engineer and iron ship-builder, Glasgow, 1852.

Dimensions.	ft.	tenths.
Length on deck	156	9
Breadth on do., amidships	16	1
Depth of hold, do.	8	2
Length of quarter-deck	42	0
Breadth of do.	13	2
Depth of do.	0	6
Length of engine-space	40	0
Tonnage.	Tons.	
Hull	$159\frac{53}{100}$	
Quarter-deck	$3\frac{6}{105}$	
Total	$162\frac{59}{100}$	
Contents of engine-space	$57\frac{15}{100}$	
Register	$105\frac{44}{100}$	

One steeple-engine (on the 4-piston-rod patent principle of Mr. David Napier) of 63 horse (nominal) power; diameter of cylinder, $44\frac{3}{8}$ inches × 3 feet 6 inches length of stroke; diameter of air-pump, 25 inches × 1 foot 9 inches length of stroke. Overhung paddle-wheels: diameter, extreme, 16 feet $7\frac{1}{2}$ inches; ditto effective, 16 feet $\frac{1}{2}$ inch. Has 16 floats, 5 feet 10 inches × 1 foot 2 inches; 3 floats in the water, at the average draft of 3 feet $6\frac{1}{2}$ inches forward, and 3 feet $9\frac{1}{2}$ inches aft. Two cylindrical return-flue boilers, 6 feet 9 inches × 19 feet 6 inches, with 4 cylindrical return-flues, 15 inches × 7 feet. Two furnaces in each boiler: length, 5 feet 9 inches; breadth 2 feet 9 inches; depth, 3 feet 6 inches. Steam-chest, 6 feet 6 inches × 3 feet 6 inches; average steam-pressure, 16 lbs. per square inch. Consumes 12 cwt. of coals per hour, and averages from 36 to 37 revolutions per minute.

Stem and stern-post, 4 × 1 inch ; keel, 3 × $\frac{7}{8}$ inches ; frames, $2\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{5}{16}$ inches, and 2 feet 6 inches apart; keel-plates, $\frac{5}{16}$ of an inch ; gunwale-plates, $\frac{3}{16}$ of an inch. Has a very comfortable steerage, 27 feet 9 inches long; mean breadth, 7 feet 2 inches, and 6 feet 8 inches in height. The fore cabin is 14 feet 6 inches square, and 6 feet 6 inches high, and neatly finished. The steward's bar is very large, and fitted with all necessary conveniences, &c. The after-cabin is painted oak and gold on the walls, and the roof white, the seats being covered with crimson plush-velvet. There are two beautiful mirrors at the entrance to the saloon, with 2 circular mahogany tables, which are screwed into the floor and taken off, as is found convenient. The saloon is 30 feet 8 inches long, and a mean breadth of 11 feet 3 inches, and 6 feet 6 inches high. The paddle-boxes are ornamented with the Glasgow arms, supported by two female figures. Plying on the station from Glasgow to Port Glasgow, Greenock, Gourock, Killcreggan, Dunoon, Rothsay, Innellan, &c.

Launched April the 3rd, from the yard at Kelvin-Kaugh. Launching-draft of water, 2 feet. Commenced plying in June.

DESCRIPTION.

A scroll-figure (a female on each side of the bows on bulwark) ; no galleries ; no bowsprit ; 1 mast; sloop-rigged ; common bow ; square-sterned and clinch-built vessel; owned by the builder. Port of Glasgow ; commander, Mr. Gilbert M'Donald.

The Thames and Clyde Steam Shipping Company's new iron screw steam vessels—

"METROPOLITAN," AND "COSMOPOLITAN."

Built and fitted by Mr. Robert Napier, engineer and iron shipbuilder, Glasgow.

Dimensions.	*Metropolitan.* ft.	tenths.	*Cosmopolitan.* ft.	tenths.
Length on deck	189	9	192	9
Breadth on do., amidships	26	9	27	0
Depth of hold, do. ..	16	4	16	5
Length of shaft tunnel ..	31	4	..	
Breadth of do.	1	6	..	
Depth of do.	4	3	..	
Length of gearing space ..	24	7	..	
Breadth of do.	7	2	..	
Depth of do.	4	3	..	
Length of engine space ..	50	1	50	6
Tonnage.	Tons.		Tons.	
Hull..	$589\frac{91}{100}$		$600\frac{61}{100}$	
Contents of engine space ..	$239\frac{20}{100}$		$242\frac{90}{100}$	
Do. of shaft tunnel ..	$2\frac{33}{100}$		..	
Do. of gearing space	$8\frac{27}{100}$		..	
Total of engine, shaft, and gearing rooms	$249\frac{80}{100}$		$250\frac{15}{100}$	
Register	$340\frac{11}{100}$		$350\frac{46}{100}$	

Metropolitan, a pair of geared beam engines, of 124 horse (nominal) power; diameter of cylinders, 45 inches × 3 feet length of stroke ; *Cosmopolitan*, engines same as above, of 130 horse (nominal) power; diameter of cylinders, 45 inches × 3 feet 6 inches; diameter of screw, 9 feet, having 3 blades ; one tubular boiler, 720 brass tubes, and 5 furnaces; average steam pressure, 16lbs. per square inch. *Metropolitan* averages from 42 to 44 revolutions per minute ; *Cosmopolitan*, ditto, from 38 to 40. The coal bunker carries 180 tons of coals, and the hold carries 500 tons of cargo, dead weight.

Stem and keel, 7 × $2\frac{1}{2}$ inches; stern-post, $7\frac{1}{2}$ × 3 inches; frames, 4 × 3 × $\frac{1}{2}$ inches, and 18 inches apart; plates from $\frac{5}{8}$ to $\frac{3}{8}$ of an inch in thickness ; average load-draft of water, 14 feet forward, and 14 feet 9 inches aft. The *Metropolitan* was launched at 22 minutes past 2, p.m., on the 13th of August, 1851, the vessel being named by Miss Brown, daughter of George Brown, Esq., of the firm of Messrs. Charles Tennent and Co., St. Rollox Works, Glasgow. Launching draft of water, forward, 5 feet $6\frac{1}{2}$ inches, and 6 feet 8 inches aft. *Cosmopolitan*, launched from the building-yard, Govan, on the 21st of April.

Cosmopolitan, Greenock, June 22nd, at 7 o'clock in the evening, arrived from London in 66 hours, being the first voyage from London to Glasgow.

Metropolitan, London, June 23rd, arrived from Greenock in 71 hours, and from Glasgow to London in 73 hours.

DESCRIPTION.

A bust male figure-head (*Metropolitan*, Lord Mayor of London in his robes ; *Cosmopolitan*, Baron Humboldt, the great traveller); no galleries; flush on deck ; standing bowsprit ; three masts; schooner-rigged ; square sterned and clinch-built vessels; clipper bows; Port of Glasgow.

Metropolitan, commander, Mr. Graham C. M'Lean.
Cosmopolitan, „ Mr. John Miller.

Messrs. Robert Barclay and Curle, Finnieston, Glasgow, are preparing to lay down the keel of an iron sailing ship for the foreign trade. Will be flush on deck, having a round stern and clipper bow, and is owned by the builders.

Dimensions.	ft.	in.
Length of keel and fore-rake	162	0
Breadth of beam	28	0
Depth of hold	19	0
	Tons.	
Tonnage	$608\frac{40}{94}$	

The keel and stem are 9 × $2\frac{1}{4}$ inches; stern post 7 × $3\frac{1}{2}$ inches; frames 4 × 3 × $\frac{1}{2}$ inch, and 15 inches apart; plating; keel strake $\frac{3}{4}$ of an inch, bottom $\frac{11}{16}$ to $\frac{5}{8}$ of an inch; sides $\frac{9}{16}$ to $\frac{1}{2}$ of an inch; wales and shear strake $\frac{5}{8}$ of an inch.

MEADOWSIDE, GLASGOW.

Messrs. Tod and M'Gregor, engineers and iron ship-builders, launched from their building-yard, on the 29th of April, the Pasha of Egypt's splendid new paddle-wheel steam yacht, *Faid Effendes* (Divine Favour), with a pair of oscillating engines and one tubular boiler; feathering paddle-wheels. She is being fitted out in the most gorgeous and costly style possible.

May the 20th was also launched by this firm the screw steam-vessel *Bombay;* launching draft of water forward 7 feet 10 inches, and 9 feet 8 inches aft; mean 8 feet 9 inches. This vessel is similar in all respects to the *Madras*, launched on 10th January.

CARTSDYKE (GREENOCK).

Messrs. Caird and Co., engineers and iron ship builders, have on the stocks and nearly in frame, an iron steam vessel, to be named the *Atrato*, the property of the West India Royal Mail Steam Navigation Company, and will be the largest vessel ever built in Scotland.

Dimensions.	ft.	in.
Length of keel and fore-rake	315	0
Breadth of beam	42	0
Depth of hold	34	0
	Tons.	
Tonnage	$2{,}720\frac{11}{94}$	

A pair of side lever engines, of 814 horse (nominal) power; diameter of cylinders 96 inches × 9 feet length of stroke; feathering paddle wheels, diameter 40 feet, 16 floats 12 feet × 4 feet 6 inches; 4 return-flue boilers. Has a clipper bow, and will be launched during the present year, to supply the place of the *Demerara*, which was unfortunately wrecked at the Devil's Point on the river Avon, near Bristol, November the 10th.

Mr. James M'Millan, shipbuilder, has on the stocks and building, a 9 years, A 1, barque, nearly ready to launch, flush on deck, with a round-house, for the foreign trade.

Dimensions.	ft.	in.
Length of keel and fore-rake	117	0
Breadth of beam	26	2
Depth of hold	18	2
Tonnage.	Tons.	
O.M....	$370\frac{48}{94}$	
N.M. (about)	420	

PEMBROKE.

In Her Majesty's dock-yard, at present on the stocks, and nearly ready to launch, the steam sloop of war *Windsor Castle*, of 140 guns. Engines by Mr. Robert Napier, Glasgow.

Dimensions.	ft.	in.
Length of keel and fore-rake	240	0
Breadth of beam	59	2
Depth of hold	24	8
	Tons.	
Tonnage	$3{,}826\frac{91}{94}$	

A pair of horizontal (geared) engines, of 596 horse (nominal) power; diameter of cylinders 94 inches × 4 feet length of stroke; and tubular boilers. She is shortly expected in Glasgow to receive the machinery, &c.

GREENOCK.

Messrs. Robert Steele and Co., shipbuilders, launched from their building-yard, on the 27th of May, 1851, the brig *Dante* (of Greenock), for the Newfoundland, Brazil, West India, and Mediterranean trades, classed 13 years, A 1; owned by Messrs. Baine and Johnstone, merchants.

Dimensions.	ft.	tenths.
Length on deck	104	2
Breadth on do„ amidships	19	8
Depth of hold do.	13	0
Length of quarter-deck	16	6
Breadth of do.	20	6
Depth of do.	1	2
Tonnage.	Tons.	
Hull	$185\frac{36}{100}$	
Quarter-deck	$4\frac{44}{100}$	
Total	$189\frac{80}{100}$	
Tonnage (loaded act.)	Tons.	
Hull	$206\frac{41}{130}$	
Quarter-deck	$3\frac{20}{130}$	
Total	$209\frac{61}{130}$	
Builders' measurement.	ft.	in.
Length keel and fore-rake	105	0
Breadth of beam...	21	6
	Tons.	
Tonnage	$226\frac{29}{94}$	

On December 24th, 1851, there was launched by this firm the steam vessel *Plata* (late the *Arabia*), bought by the West India Royal Mail Company, to supply the place of the *Amazon*.

Dimensions (builders' measurement).	ft.	in.
Length of keel and fore-rake	285	0
Breadth of beam...	40	8
Depth of hold	27	8
Length of engine space	82	9
Tonnage.	Tons.	
Hull	$2{,}292\frac{42}{94}$	
Engine space	$706\frac{58}{94}$	
Register ... ... —	$1{,}585\frac{78}{94}$	
Customs' measurement.	ft.	tenths.
Length on deck...	284	4
Breadth on do., amidships	37	4
Depth of hold, do.	27	7
Length of engine space	82	8
Tonnage.	Tons.	
Hull	$2{,}402\frac{98}{100}$	
Contents of engine space	$928\frac{34}{100}$	
Register	$1{,}474\frac{64}{100}$	

A pair of side lever engines, by Mr. Robert Napier, Glasgow, of 960 horse (nominal) power; diameter of cylinders, 103 inches × 10 feet length of stroke; paddle-wheels, diameter effective, 27 feet; 28 floats, 9 feet 6 inches × 3 feet 6 inches ; tubular boilers with 2 funnels; draft of water at launch, 10 feet 5 inches (mean); do., with machinery, &c., 15 feet; has accommodations for 180 passengers; capacity of coal bunkers, 1,300 tons. Has 2 masts, brig-rigged; bust male figure head ; round-sterned and carvel-built vessel ; standing bowsprit ; flush on deck ; Port of London.

Ou June the 4th, 1852, there was launched by this firm a very handsome screw steam-vessel, named the *Larriston*, for the Bombay and Cbiua trade, classed 13 years, A 1.

DIMENSIONS.

Builders' measurement.	ft.	in.
Length of keel and fore-rake	170	10
Breadth of beam	26	2
Tonnage	$566\frac{29}{94}$ tons.	
Customs' measurement.	ft.	tenths.
Length on deck	167	5
Breadth on do., amidships	24	0
Depth of hold, do.	16	0
Length of quarter-deck	33	2
Breadth of do.	20	1
Depth of do.	2	4
Tonnage	Tons.	
Hull	$456\frac{72}{100}$	
Quarter-deck	$17\frac{33}{100}$	
Total	$474\frac{05}{100}$	

A pair of beam-engines, of 200 horse power, by Mr. Robert Napier, Glasgow, with a brass screw, having 3 blades.

Diameter	10 feet.
Weight of machinery and water ..	175 tons.
Do. of coals	200 "
Do. cargo (measurement goods) ..	120 "
Do. stores and outfits	55 "
Total	550 tons.

DESCRIPTION.

A lion figure-head; round-sterned and carvel-built vessel; standing bowsprit; 3 masts; schooner-rigged. Port of London. Owned by Messrs. Mathieson and Co., merchants; commander, Mr. H. P. Baylis.

THE GLASGOW AND ROTHESAY NEW IRON STEAM VESSEL "OSPREY."

Built by Messrs. Barclay and Curle, ship-builders, Finnieston, Glasgow; engine boilers, &c., by Messrs. Caird and Co., engineers and iron ship-builders, Cartsdyke, Greenock, 1852.

Dimensions.	ft.	tenths.
Length on deck..	169	6
Breadth on do., amidships	18	5
Depth of hold, do.	8	8
Length of engine space	47	1
Tonnage.	Tons.	
Hull	$193\frac{93}{100}$	
Contents of engine space	$82\frac{98}{100}$	
Register..	$110\frac{95}{100}$	

One steeple engine of 101 horse (nominal) power; diameter of cylinder 54 inches × 4 feet 4 inches, length of stroke; diameter of air-pump 24 inches, same stroke as cylinder; diameter of paddle wheels, extreme 19 feet, and 18 feet $6\frac{1}{2}$ inches, effective; seventeen floats, 6 feet 7 inches × 1 foot 3 inches. Two tubular boilers—length above, 8 feet 3 inches; ditto at furnaces, 7 feet 3 inches; breadth, 11 feet 3 inches; depth, 7 feet 9 inches: steam-chests, length above, 5 feet 6 inches; ditto below, 6 feet 6 inches; breadth, 6 feet 6 inches; depth, 4 feet 9 inches. Six furnaces, three in each boiler, length 6 feet 6 inches; breadth, 3 feet; depth, 3 feet: 354 tubes, or 177 tubes in each boiler; diameter, 3 inches × 6 feet long; has two funnels, 3 feet 8 inches × 21 feet.

The steerage is 20 feet 6 inches long × 7 feet 6 inches in (mean) breadth, and 6 feet 4 inches in height. The fore-cabin saloon is 15 feet 3 inches × 12 feet; the main cabin saloon is 33 feet 6 inches long; and 15 feet 9 inches (mean) breadth; and the seats are crimson velvet cushions. Round the edges of the seats and the panels is bird's-eye maple; and between the side windows are very rich-coloured stained pictures on glass, representing views in Italy, Germany, Switzerland, France, Wales, and Scotland, the production of Thomas Lawrie, Esq., of Glasgow. No. 1, Lake of Como; 2, Castle of Gandolphe; 3, Ancona; 4, Inverary; 5, Vale of Tempe; 6, Rocca d'Ampbi; 7, Mill on the Llanberris; 8, Taymouth Castle; 9, Venice; 10, Mount Etna; 11, Louvre; 12, Pavia; 13, Pisa; 14, Vale of Laugollen. The upholstery was by Mr. James Fisher, of Glasgow. The saloon is also furnished with five very large mirrors in gilt frames, and two marble side-boards. The ladies' cabin is 11 feet long. This vessel is fitted up with every accommodation for the comfort of passengers. Frames of hull, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$ inches, and 2 feet 3 inches apart; plates, $\frac{5}{16}$ to $\frac{3}{16}$ of an inch; breadth over the paddle cases, 35 feet 6 inches. Launched, May the 22nd. Draft of water at launching, forward, 2 feet 6 inches, and 2 feet 9 inches aft. On the trial trip, in June, the engine made 32 revolutions per minute, the mean steam pressure being 15 lbs. per square inch, and consumed 16 cwt. of coals per hour; the speed of the vessel being about 15 miles per hour; the draft of water being 4 feet 7 inches forward, and 4 feet $7\frac{1}{2}$ inches aft.

DESCRIPTION.

No figure head, galleries, or bowsprit; one deck (flush), one mast, sloop rigged, square sterned, and clinch-built vessel. Port of Glasgow. Commander, Mr. Neil M'Gill.

THE GLASGOW AND KILMAN NEW IRON STEAM-VESSEL, "KOH-I-NOOR" (MOUNTAIN OF LIGHT).

Built and fitted by Messrs. Thomas Wingate, and Co. engineers and iron ship-builders, White Inch, Glasgow, 1850.

Dimensions.	ft.	tenths.
Length on deck	146	4
Breadth on do., amidships	11	3
Depth of hold, do.	6	1
Length of engine-space	32	8
Tonnage.	Tons.	
Hull	$74\frac{16}{100}$	
Contents of engine-space	$24\frac{46}{100}$	
Register	$49\frac{70}{100}$	

A pair of diagonal engines (with oscillating piston-rods, each cylinder facing, and connected to the one crank-pin), of 32 horse (nominal) power: diameter of cylinders, 25 inches × 2 feet 1 inch, fitted with a beam-engine for working the air-pumps, also the feed and bilge-pumps. The other engines are solely used to propel the vessel, and are fitted with reversing gear. The paddle-wheels are on Mr. Morgan's patent feathering principle: diameter, 11 feet; eight floats, 4 feet × 2 feet. Has one patent vertical boiler, 2 furnaces, and 458 (composition) tubes. Patent condensers at bilges; frames, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$ inches, and 2 feet 6 inches apart; 5 strakes of plates from keel to gunwale; draft of water, 3 feet 3 inches, even keel; steam-pressure, 18 lbs. per square inch; engines making 60 revolutions per minute; consuming about 10·2 cwt. of coals per hour; and sails very fast. Plying from Glasgow to Port Glasgow, Greenock, Gourack, Kilcreggan, Dunoon, Kilman, Sandbank, &c.

DESCRIPTION.

No figure-bead, galleries, bowsprit, or mast; one deck, flush; square-sterned and clinch-built vessel. Port of Glasgow; commander, Mr. Neil M'Bean.

THE GLASGOW AND ROTHSAY NEW IRON STEAMER, "EAGLE."

Built by Messrs. Alexander Denny and Brother, iron ship-builders, Dumbarton. Engines, boilers, &c., by Messrs. Campbell, M'Nabb, and Clark, engineers, Shawswater Foundry (Greenock), 1852.

Dimensions.	ft.	tenths.
Length on deck	167	0
Breadth on do., amidships	16	1
Depth of hold	8	3
Length of engine-space	45	8
Tonnage.	tons.	
Hull	$176\frac{54}{100}$	
Contents of engine-space	$66\frac{23}{100}$	
Register	$110\frac{31}{100}$	

A pair of oscillating engines, of 82 horse (nominal) power; diameter of cylinders, 36 inches × 3 feet 3 inches. One inclined air-pump, with trunk motion, fitted with Morgan's patent feathering paddle-wheels; diameter, 15 feet 2 inches. Nine floats, 6 feet × 2 feet 4 inches. One tubular boiler; length above, 18 feet 6 inches; do. below, 17 feet 6 inches; breadth, 8 feet 2 inches; depth, 8 feet. Four furnaces, two in each end (being fired fore and aft); length, 7 feet; breadth, 3 feet 3 inches; depth; 3 feet; dry bottoms. Two steam-chests, 4 feet 6 inches × 4 feet 6 inches. 280 tubes (brass); diameter, $2\frac{3}{4}$ inches × 6 feet long. Has two funnels, one on each end of the boiler. Boiler to bulk-head, 7 feet 6 inches. Frames of hull, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$ inches, and 2 feet apart. Steam-pressure, 25 lbs. per square inch; engines making 44 revolutions per minute, consuming 16·4 cwt. of coals per hour. Has good accommodations for passengers, &c. In the panels in the main-cabin are carved representations in wood of the arts, sciences, literature, and music; seats of crimson velvet; panels, oak and gold, &c.; roof white, blue, and gold. Commenced to ply May the 12th.

DESCRIPTION.

No figure-head, galleries, or bowsprit; 1 mast; sloop-rigged; one deck (flush); square-sterned and clinch-built vessel. Port of Glasgow; commander, Mr. Richard Price.

REVIEW.

Atmosphere; a Philosophical Work. By George Woodhead, Esq. 8vo., pp. 146. London: H. Ballière.

THIS work, as we are informed by notes appended to each chapter, is a reprint of certain articles which have appeared in the *Mechanics' Magazine.* We must let the author "review" himself, for we have not the courage to begin. The following extracts may serve to give our readers an idea of Mr. Woodhead's philosophy:—

"If the ends of the two conducting wires (of a galvanic battery) are dipped in water, aëriform, elastic fluids or gases, called oxygen and hydrogen, come from them; the oxygen coming from one wire, the hydrogen from the other; which gases, according to many opinions, are somehow formed from the water, but in this opinion I do not concur. It seems to me that these gases or fluids are derived from the atmosphere; that they are but modifications of atmospheric air; and that they come from the battery through the conducting wires. I think so, because the fluids issue from the wires, and may be diverted at any part of them; because atmospheric air can be forced copiously through many kinds of wood and stone (a vacuum being made under them) by atmospheric pressure alone, and because all metals are, and necessarily must be, saturated with air in the process of their smelting, formation, and manufacture."

"If a piece of red-hot iron, or any other red-hot substance is plunged into water, the air it contains, and which is the cause of its redness, will be seen issuing from it in innumerable bubbles."

"Light may be caught and examined, when it is found to be air."

We have met with nothing like this since the celebrated theory of extracting sunbeams from cucumbers. If our readers are curious to learn more of such philosophy, they had better go to the fountain-head—we dare not trust ourselves with a deeper draught.

CHANNELS FOR INVESTMENT.

LIST OF NEW COMPANIES LATELY ESTABLISHED OR PROPOSED.

	Amount of Share.	No. of Shares.	Capital.
Deeside Railway	£10	10,625	£106,250
Shrewsbury and Aberystwith do.	20	37,500	750,000
Somerset Central do.	20	35,000	70,000
African Steam Navigation	20	12,500	250,000
Steam and Atmospheric Patent Propulsion	1	40,000	40,000
Aubin Coal and Iron	5	32,000	160,000
Fairhead Harbour	1	250,000	250,000
Netherlands and Hanover Junction Canal	£2 10s.	50,000	125,000
Cheesewing Granite	1	20,000	20,000
Patent Silicious Stone	10	5,000	50,000
Chiriqui Road	5	40,000	200,000
The Monarch Gold Mining (Aust.)	10s.	25,000	12,500
Royal Australian Banking and Gold Importing	£5	50,000	250,000
Great Australian Emigration	1	100,000	100,000
Australian Emigrants' Aid and Transit Society	10s.	20,000	10,000
Port Phillip and General Emigration Colonisation, and Investment	£1	50,000	50,000

RECENT AMERICAN PATENTS.

For an *improvement in machines for scouring knives and forks;* Christopher Aumock, Columbia, Ohio, January 13.

Claim.—"I claim the construction of this machine, composed of two cylinder brushes, with their peripheries in contact, which causes the friction necessary for scouring or polishing, and at the same time keeps the cylinder brushes, which do the work of polishing or scouring, wet with the polishing substance continually, while the machine is in motion, by immersing the under side of said brushes in the liquid as they revolve around on their axis, as above mentioned. The article to be scoured or polished must be held in a perpendicular position, and moved up and down between the cylinder brushes while in the act of scouring or polishing."

For an *improvement in ornamental painting on glass, &c.;* John W. Bowers, Brookline, Massachusetts, January 13.

"My process imparts to a painting on glass an appearance very much like those figures which are executed on wood or papier-maché, and which are more or less, or in part, made up of pieces of mother of pearl let into the wood. The paintings or figures produced by my said method have very beautiful properties of reflecting light, such are often exhibited by silvered prismatic or crystalline surfaces."

Claim.—"What I claim as my improvement in ornamenting surfaces, consists in combining with the process of painting and ornamenting, by metallic foil, that of corrugating or crimping the foil, so as to impart to the figure or figures a power of reflecting light, so as to produce the sparkling, scintillated appearance as specified."

For an *improvement in sand-paper holder;* Azel H. Copeland, West Bridgewater, Massachusetts, January 27.

Claim.—"Having thus described my invention, I shall state my claim as follows: what I claim as my invention is, the implement called a sand-paper holder, constructed substantially, as above described; that is, of two similar pieces of wood, with handles at the ends, the inner sides flat, and the other sides rounded, joined together lengthwise by a hinge of cloth or leather, so that the flat sides can be brought together; the outer edges of the flat sides having small wire-pins inserted in them, by which the sand-paper is held, and the two pieces being held together, when closed, by dowels in one of the flat sides entering corresponding holes in the other flat side."

For an *improved mode of preventing collisions on railroads;* Thomas A. Davies, City of New York, February 10.

"The nature of my invention consists in applying to a locomotive engine a sound-gatherer with an ear-piece, in such a manner that any extraordinary noise made by the approach of a train, or by a steam whistle, or any known way of making a great noise, is gathered and communicated to the ear of the engineer in time to stop his engine, or train, as the case may be."

Claim.—"What I claim as new and original is, the application of a sound-gatherer with an ear-piece, to a locomotive engine, or train of cars, arranged substantially as above described, so that the engineer or another can ascertain by sound the approach of a locomotive or train, in time to prevent collision."

For *improvements in railroad gates;* Egbert P. Carter, Yorkshire, New York, February 17.

"The nature of my invention consists in so constructing rail gates, to be opened and held open by the action of the cars in passing, as that the gate shall swing upward in the arc of a circle, from an axis in the centre of the hub of the gate, by means of a shaft, which the passing train first rotates and then holds fixed, thus avoiding the necessity of having any portion of the apparatus to sink below the level of the track, which is liable to become inoperative by snow, ice, &c."

Claim.—"Having thus fully described my invention, what I claim therein as new is, the method herein described for balancing a railroad or other gate, viz., by means of a spring, coiled around a stationary axis, to which it is attached by one end, the other end being attached to the disk which forms the hub or centre of the gate turning on said axis, substantially as herein described.

"I also claim the use of the rock shaft, provided with the cam ledges and straight ledge, to be operated upon by the wheels of the passing train, and the cams for winding up the chains which draw up the gates; the whole being arranged in the manner and for the purpose herein substantially set forth and shown."

NOTES FROM CORRESPONDENCE.

⁂ We cannot insert communications from anonymous correspondents.

Copeland's Metallic Packing.—We have received a letter from Mr. Copeland, in reference to the claim of Mr. Hunt (p. 110) to the invention of the metallic packing. Mr. C. refers to the published description of Mr. Hunt's invention in the *Glasgow Mechanics' Journal*, p. 176, vol. 1848, in which no provision is shown for lateral play, which Mr. Copeland states to be absolutely essential to its proper working. As registered by Mr. Hunt, it has been tried repeatedly in the United States, and failed, as it either destroyed the piston-rod, or the packing itself was destroyed.

Continuous Indicator for Steam Engines, "J. G., Halifax."—A simple continuous indicator would be a most valuable instrument, but we are not aware that there is one at work in this country. Dr. Lardner arranged a very complete one for the *Great Western*, which registered the fluctuations of the steam in the cylinder and boiler, and vacuum in the condenser, &c.; but it was too delicate an affair for an engine-room at sea, and too much trouble for the engineers. We shall be happy to see his plan.

"An Architect."—We presume there can only be one opinion of the bad taste (to use a mild term), of dragging the private circumstances of a gentleman before a gaping world; but we think we should best consult the feelings of those most entitled to sympathy, by refraining from keeping public attention attracted to the subject.

Carrett's Steam-Pump.—Mr. Carrett has written us to call our attention to the superiority of his arrangement of pumps over Worthington and Baker's, in which no expansion can be used, and which consequently require more steam. We coincide with Mr. Carrett as to this fact, and for land engines of larger size, we should prefer his arrangement, whilst Worthington's, from its simplicity and compactness, has advantages for marine purposes, where steam is of little object.

[*Erratum.*—In the description of the *Times* steamer, p. 157, for "123 miles in 10½ hours," read "138 miles in 11½ hours.

LIST OF ENGLISH PATENTS,

From 24th of June, to 22nd July, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Samuel Lusty, of Birmingham, for improvements in manufacturing wire into woven fabrics and pins. June 24.

Thomas Boll, of Don Alkali Works, South Shields, for improvements in the manufacture of sulphuric acid. June 24.

Joseph Morgan, of Manchester, patent candle-machine manufacturer, and Peter Gaskell, of the same place, gentleman, for improvements in the manufacture of candles. June 24.

Charles James Wallis, of Clarendon Chambers, Hand-court, Holborn, civil engineer and mechanical draughtsman, for improvements in machinery for crushing, pulverising, and grinding stone, quartz, and other substances. June 24.

Thomas Bazley, of Manchester, cotton spinner, for improvements in machines for combing cotton, flax, silk, and other fibrous materials. June 24.

John M'Conochie, of Liverpool, engineer, for improvements in locomotive and other steam engines and boilers, in railways, railway carriages, and their appurtenances; also in machinery and apparatus for producing part or parts of such improvements. June 24.

Thomas Allan, of Edinburgh, engineer, for improvements in producing and applying electricity, and in apparatus employed therein. June 24.

Thomas Hoblyn, Esq., of White Barns, Hertford, for certain improvements in the art of navigation. June 28.

Matthew Augustus Crooker, engineer, of the City of New York, America, for certain improvements in paddles for steam vessels. June 28.

James Edward Coleman, of Porchester House, Bayswater, gentleman, for improvements in the application of India-rubber and gutta percha, and of compounds thereof. June 28.

Duncan Mackenzie, of London, gentleman, for certain improvements in machinery and apparatus for reading in and transferring designs or patterns, and for cutting, punching, and numbering, or otherwise preparing perforated cards, papers, or other materials used or suitable in the manufacture of figured textile fabrics by Jacquard's or other weaving looms or frames. June 29.

Lazare François Vandelin, of Upper Charlotte-street, Fitzroy-square, for improvements in obtaining wool, silk, and cotton, from old fabrics, in a condition to be again used. (Being partly a communication.) June 30.

Richard Hornsby, of Spittlegate, Grantham, Lincoln, agricultural-implement maker, for improvements in machinery for threshing, shaking, riddling, and dressing corn. July 3.

Edward Clarence Shepard, of Duke-street, Westminster, gentleman, for improvements in electro-magnetic apparatus suitable for the production of motive power, of heat, and of light. (Being a communication.) July 6.

Martyn John Roberts, of Woodbank, Bucks, gentleman, for improvements in the production of electric currents, in obtaining light, motion, and chemical products and effects, by the agency of electricity, part or parts of which improvements are also applicable to the manufacture of acids, and to the reduction of ores. July 6.

William Tanner, of Exeter, leather dresser, for improvements in dressing leather. July 6.

Edward Maitland Stapley, of Cheapside, for improvements in cutting mouldings, grooves, tongues, and other forms, and in planing wood. (Being a communication.) July 6.

Moses Poole, of the Patent-office, London, gentleman, for improvements in reaping and mowing-machines, and in pulverising land. (Being a communication.) July 6.

Thomas Blakey and Joseph Skaife, of Keighley, York, millers, for improvements in mills for grinding. July 6.

James Higgins, of Salford, Lancaster, machine-maker, and Thomas Schofield Whitworth, of the same place, mechanic, for certain improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances. July 6.

Harold Potter, of Over Darwen, Lancaster, carpet-manufacturer, and Matthew Smith, of the same place, manager, for certain improvements in looms for weaving, and in the manufacture of terry fabrics. July 6.

Jules Lemoine, chemist, of Courbevoie, near Paris, for an improved composition applicable to the purposes of varnish, to the waterproofing of fabrics, to the manufacture of transparent fabrics, to the fixing of colours, and to other useful purposes. July 6.

John Henry Johnson, of 47, Lincoln's Inn-fields, Middlesex, and of Glasgow, North Britain, gentleman, for improvements in steam-engines. (Being a communication.) July 6.

Alfred Henry Gaullie, of Paris, sculptor, for an improved plastic composition applicable to manufacturing purposes. July 6.

William Septimus Losh, of Wreay Syke, Cumberland, gentleman, for improvements in obtaining salts of soda. July 6.

James Murdoch, of Staple-inn, Holborn, Middlesex, for an improvement in the manufacture of certain kinds of woollen fabrics. (Being a communication.) July 6.

John Andrews, of Fair Oak-terrace, Minde, Newport, Monmouthshire, contractor, for certain improvements in coke ovens, and in the apparatus connected therewith. July 6.

Frederick Sang, of Pall-mall, artist in fresco, for certain improvements in machinery or apparatus for cutting, sawing, grinding, and polishing. July 6.

Friedrich Gesswein, of Cannstadt, Wurtemberg, stone-mason, for a method of preparing for baking and burning masses of clay of any given form and size, and baking and burning the same when so prepared, as thoroughly and completely as a common brick can now be baked or burnt. July 6.

John Ramsden, of Manchester, screw-bolt manufacturer, for certain improvements in machinery or apparatus for cutting screws. July 6.

Joseph Jepson Oddy Taylor, of Gracechurch-street, London, machinist, for an extension for the term of four years, from the 1st day of May last, for part of his invention described in the original letters patent under the title of, "An improved mode of propelling ships and other vessels on water." July 6.

Warren Stormes Hale, of Queen-street, Cheapside, candle-maker, and George Roberts, of Great Peter-street, Westminster, miner, for improvements in the manufacture of night lights or mortars. July 8.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in machinery for cutting soap into slabs, bars, or cakes. (Being a communication.) July 10.

Thomas Jordan, of Old Broad-street, London, for improvements in disinfecting essential oils, and in treating fatty matters obtained from shale schistus, or other bituminous substances, and in retorts employed in distilling such materials. July 12.

Joseph Baron Palur, of Castle-street, Holborn, for an improved mode of baking bricks, tiles, and other kinds of pottery or earthenware. July 13.

Charles Burrell, of Thetford, Norfolk, and Matthew Gibson, of Rollington-terrace, Newcastle-on-Tyne, for improvements in reaping machines. July 15.

George Hinton Bovill, of Abchurch-lane, London, for improvements in manufacturing wheat and other grain into meal and flour. July 15.

Moses Poole, of the Patent-office, London, gentleman, for improvements in boots, shoes, clogs, and similar articles. (Being a communication.) July 15.

Henry John Gauntlett, of Charlotte-street, Portland-place, Middlesex, doctor in music, for improvements in organs, seraphines, and other similar wind instruments, and also improvements in pianofortes. (Being a communication.) July 15.

Charles Barrington, of the city and county of Philadelphia, in America, gentleman, for an improved steam-boiler water-feeding apparatus, and furnace therefor. (Being a communication.) July 15.

Charles James Pownall, of Addison-road, Middlesex, gentleman, for improvements in the treatment and preparation of flax and other similar fibrous vegetable substances. July 15.

Thomas Richards, of St. Erth, and Samuel Grose, of Gwinear, both in Cornwall, for certain improvements in machinery for reducing and pulverising ores, minerals, stones, and other substances. July 15.

John Hunt, of Rennes, France, gentleman, for certain machinery for washing and separating ores. July 16.

William Fawcett, of Kidderminster, Worcester, for certain improvements in the manufacture of carpets. This patent being opposed at the Great Seal, was not sealed till 17th inst., but bears date the 2nd February last, by order of the Lord Chancellor.

Joseph William Schlesinger, of Brixton, Surrey, gentleman, for improvements in fire-arms, in cartridges, and in the manufacture of powder. (Being part y a communication.) July 20.

Julius Friedrich Phillipp Ludwig von Sparre, of Brewer-street, Golden-square, mining engineer, for improvements in separating substances of different specific gravities, and in the machinery and apparatus employed therein. July 20.

Stribblehill Norwood May, of Fitzroy-square, gentleman, for certain improvements in the manufacture of thread, yarn, and various textile fabrics, from certain fibrous matters. July 20.

Emery Rider, of Bradford, Wilts, manufacturer, for improvements in the manufacture or treatment of India rubber or gutta percha, and in the application thereof. July 20.

John Shaw, of Dukinfield, Chester, cylinder maker, for certain improvements in machinery or apparatus for carding cotton, wool, flax, and other fibrous materials. July 20.

Sir William Burnett, Knight Companion of the most Honourable Order of the Bath, of Somerset-house, Middlesex, an extension for the term of seven years from the 26th day of July, 1852, being the expiration of the original grant of his patent for improvements in preserving wood and other vegetable matters from decay. July 20.

John Francis Egan, of Covent-garden, for improvements in the manufacture of sugar. (Being a communication.) July 20.

James M'Henry, of Liverpool, merchant, for certain improvements in machinery for manufacturing bricks and tiles. (Being a communication.) July 20.

Richard Bealey, of Radcliffe, Lancaster, bleacher, for certain improvements in apparatus used in bleaching. July 20.

George Augustus Huddart, of Brynkir, Carnarvon, esq., for improvements in the manufacture of cigars. July 20.

Richard Birckton and Thomas Lawson, both of Leeds, Yorkshire, manufacturers, for certain improvements in the adaptation and application of a new manufactured material to certain articles of dress. July 21.

John Kirkham, of the New-road, Middlesex, civil engineer, and Thomas Nesham Kirkham, of Fulham, civil engineer, for improvements in the manufacture of gas for lighting and heating. July 22.

LIST OF SCOTCH PATENTS,

From 24th of May to the 18th of July, 1852.

John Harcourt Brown, of Aberdeen, Scotland, and James Macintosh, of the same place, for improvements in the manufacture of paper, and articles of paper. May 24.

Charles James Pownall, of Addison-road, Middlesex, gentleman, for improvements in the preparation and treatment of flax, and other fibrous and vegetable substances. May 28.

John Weems, of Johnstone, Renfrew, North Britain, tinsmith, for improvements in the manufacture or production of metallic pipes and sheets. May 31.

Alexander Johnson Warden, of Dundee, Forfar, Scotland, manufacturer, for improvements in the manufacture of certain descriptions of carpets. May 31.

Joseph Swan, of Glasgow, Lanark, North Britain, engraver, for improvements in the production of figured surfaces, and in printing, and in the machinery or apparatus used therein. June 10.

George Searby, of Chelsea, Middlesex, decorator, for certain improvements in apparatus for cutting and carving metal, stone, and other substances. (Being a communication.) June 11; four months.

John Frearson, of Birmingham, manufacturer, for certain improvements in cutting, shaping, and pressing metal, and other materials. June 14.

Thomas Twells, of Nottingham, manufacturer, for certain improvements in the manufacture of looped fabrics. June 14; four months.

Andrew Fulton, of Glasgow, Lanark, North Britain, hatter, for improvements in hats and other coverings for the head. June 14.

William Edward Newton, of 66, Chancery-lane, Middlesex, civil engineer, for improvements in machinery for weaving, colouring, and marking fabrics. (Being a communication.) July 15.

James Edward Coleman, of Porchester House, Bayswater, Middlesex, gent., for improvements in materials and apparatus to be employed in parts of railways, of engines, and of carriages, and in the application of such materials to those purposes, and to the manufacture of textile and other mechanism. (Being a communication.) June 16.

William Hindman, of Manchester, Lancaster, gentleman, and John Warhurst, of Newton Heath, near Manchester, cotton dealer, for certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith. June 16; four months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 66, Fleet-street, London, patent agents, "A Reaping Machine." (Being a communication.) June 17.

William Gratrix, of Salford, Lancaster, dyer and printer, for certain improvements in the production of designs upon cotton and other fabrics. June 17.

James Edward M'Connell, of Wolverton, Bucks, civil engineer, for improvements in steam engines, in boilers and other vessels for containing fluids, in railways, and in materials and apparatus employed therein or connected therewith. July 18.

DESIGNS FOR ARTICLES OF UTILITY,

From 29th of June to the 22nd of July, 1852.

June 29, 3311, Tylor and Pace, John-street, Hackney, "Heating apparatus for baths."
,, 29, 3312, T. Allan, Edinburgh, "Electrode."
,, 30, 3313, T. Hills and Son, Cooper-street, City-road, "Gold washing and reserving machine."
July 2, 3314, H. E. Campbell, Guildford-street, "Horizontal gold washing machine."
,, 2, 3315, B. Samuelson, Banbury, Oxford, "Part of a lawn mower."
,, 3, 3316, W. Dray and Co., Swan-lane, London Bridge, "Combined winnowing and blowing machine."
,, 5, 3317, W. Tasker and G. Fowle, Andover, Hants, "Convex clod-crusher or press-wheel roller."
,, 5, 3318, J. Duncan, Gresham-street, west, "Marquise joint."
,, 6, 3319, W. Dray and Co., Swan-lane, City, "Part of a reaping and mowing machine."
,, 6, 3320, F. Barnes, Union-row, Tower-hill, "Gold washing machine."
,, 7, 3321, J. Higham, Manchester, "Bugle."
,, 7, 3322, R Garrett, Saxmundham, "Manure distributor."
,, 7, 3323, Ransomes and Sims, Ipswich, "Spherical locking carriage."
,, 8, 3324, C. Burrell, Thetford, "Force pump discharge apparatus."
,, 9, 3325, W. Hensman and Son, Woburn, Bedfordshire, and S. L. Taylor, Cotton-end, near Bedford, "Steam-engine controller."
,, 9, 3326, R. E. Beauford, St. Leonards and Hastings, "Daguerreotype accelerator."
,, 9, 3327, W. Dray and Co., Swan-lane, London-bridge, "Lever and extended horse-rake."
,, 9, 3328, J. Symonds, Circus, Minories, "Gold-washing cradle."
,, 9, 3329, J. Classon, Dublin, "Steam-boat and railway chessboard and men."
,, 10, 3330, J. Crawley, Silver-street, Cheapside, "Arm-hole shirt front."
,, 12, 3331, J. R. Isaac, Liverpool, "Perpetual remembrancer."
,, 14, 3332, G. P. Thomas, St. James'-street, "Adjustable clog fastening."
,, 15, 3333, W. Starkes, Lostock, Cheshire, "Apparatus for cutting corn and other standing crops."
,, 17, 3334, M Macpherson, St. Petersburgh, "Annular boiler."
,, 17, 3335, G. H. and D. Nicholl, Dundee, "Kitchen-range."
,, 17, 3336, T. A. Readwin, Winchester-buildings, "Revolving holder for pen, pencil, or toothpick.
,, 20, 3337, H. Barber, Leicester, "Thread-carrier stop of a stocking-frame."
,, 20, 3338, Moran and Quin, Myddelton-street, Clerkenwell, "Folded spring-catch."
,, 20, 3339, W. Bown, Leicester, "Apparatus for pluffing, fluting, and preserving the shape of gloves."
,, 22, 3340, W. Wigfall, and Co., Sheffield, "Saucepan cleaner."

THE ARTIZAN.

No. IX.—Vol. X.—SEPTEMBER 1st, 1852.

THE EVENTS OF THE MONTH.

The railway world has been furnished with ample material for discussion in the revived scheme for the amalgamation of the leading companies. The London and North Western and the Great Western are to be the happy couple who are to set the example; the Midland and Great Northern are coquetting, and other matches are hinted at. It is very doubtful whether the railway interest, strong as it is in Parliament, could carry such a measure, without submitting to the supervision in detail of their entire management. The bare idea of a Government Railway Board is enough to deter shareholders from entertaining such a proposal, and most assuredly one part of the scheme could not be carried out without the other. With the Board of Customs daily before their eyes, men of business will be slow to take any steps which would hand the management of their property over to such a body. But the necessity of such an amalgamation has yet to be shown. Surely the management of a line of railway 500 miles in length, and representing fifteen millions of money, is sufficient to satiate the ambition of any chairman or any board. In such gigantic concerns no economy is possible by amalgamation which could not be attained with less risk by amicable arrangements as to the mutual working or construction of branch lines. Such appears to be the general feeling out of doors, and some go so far as to say that the whole affair has been got up merely "to throw to the whale," at the half-yearly meetings. A better reason may be found in the sense of the responsibility which directors have incurred in making unprofitable extensions and guarantees.

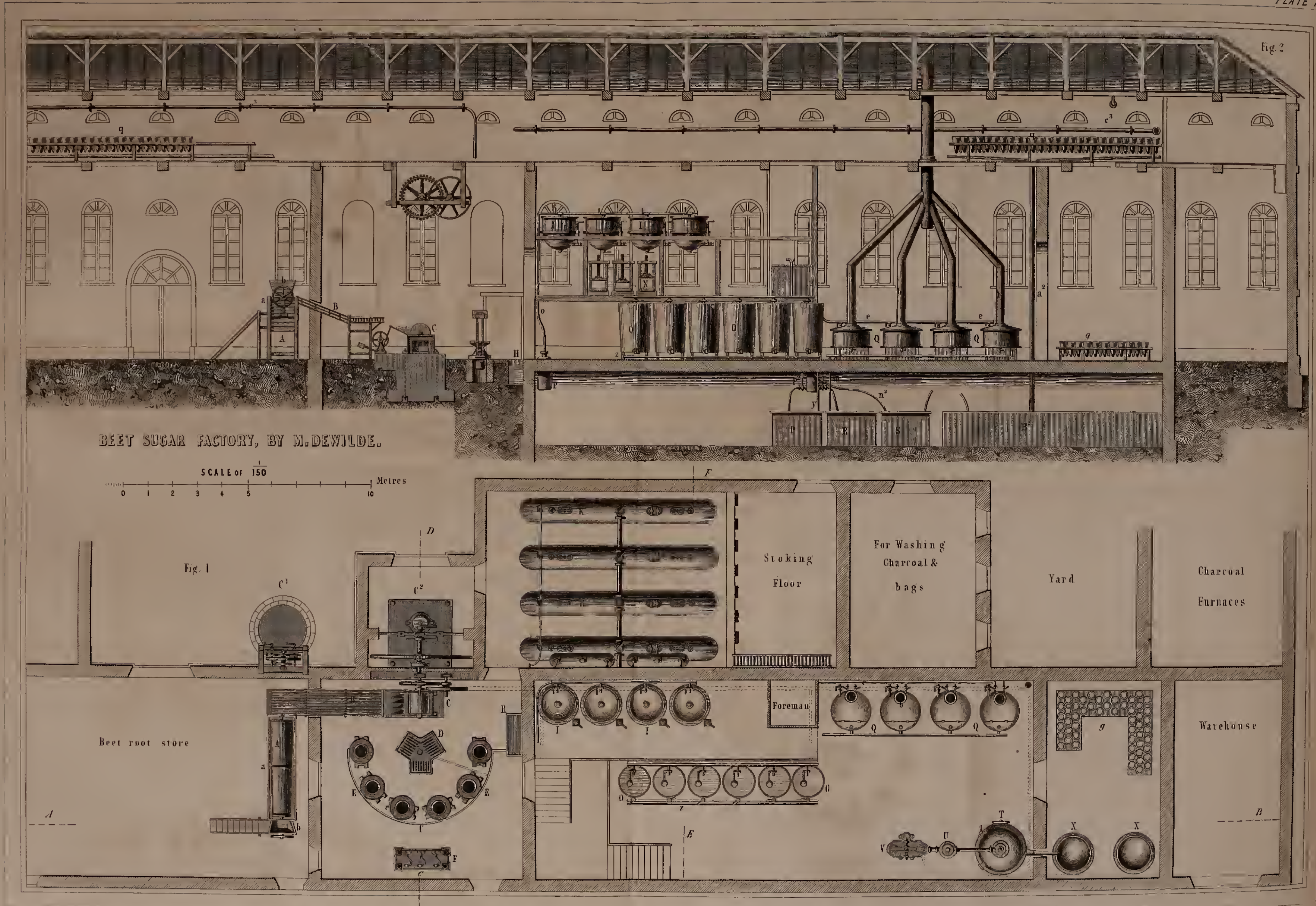
A more practicable method of increasing dividends would be the reduction of working expenses, by adopting the American system of working the trains, and by running lines *into* towns; not such extravagant extensions as the Waterloo, but a line worked by horse power to carry goods into the heart of a town. There are numerous old-fashioned towns in which the main streets are of ample width to admit of a line of rails without interfering with the ordinary traffic, and in which the gradients would not be objectionable. Such articles as coals, bricks, timber, &c., could thus be carried directly into the town without the expense of cartage.

The Salisbury and Exeter scheme is still pushed with energy by Mr. Locke and his friends, although the South Western proprietors seem insensible to the great advantages they are to derive from it. It is, in fact, a landowner's question, as Mr. Locke frankly admits, and if the landowners want the line, let them make it. It will pay them in the improvement of their property, even if the receipts only cover the expenses.

Several accidents have occurred which might have been prevented by an efficient *external* means of stopping the train. In a mere pecuniary point of view, the expense of adopting such a plan would soon be saved by the absence of compensations for accidents, which have begun to form a very ugly feature in railway balance-sheets. As this appears to be the only point on which boards of directors are accessible, we will suggest a plan by which, at the smallest possible expense to themselves, their pockets might be protected, and their consciences lightened—if, indeed, boards have any consciences at all.

Let a commission be appointed—composed of locomotive superintendents, an equal number of practical consulting engineers (not engine makers who have contracts with railway companies), and a few government officers—to inquire into the causes of, and best methods of preventing, railway accidents in general. Let the expenses of such a commission, and of the trials, be paid by a *pro ratâ* contribution from the various companies. Ten thousand pounds laid out in this way—a sum less than a single accident has cost—would settle the question.

London has usually been very free from boiler explosions, although a great proportion of the engines in it are worked with high-pressure steam. We regret, therefore, to have to record a very disastrous explosion which occurred on the 2nd instant, at a saw-mill at Wapping. The circumstances were rather peculiar. The boiler was of the best shape, cylindrical with flue through of $\frac{7}{16}$ plates; the ends were strongly stayed, the water was not low, and the pressure was only about 16 lbs. per square inch. The shell was 6 feet diameter, and we should have had no hesitation in working such a boiler to 40 or 50 lbs. per square inch. Many boilers about Manchester, of 8 or 9 feet diameter, and the same thickness of plates, are doing so with great safety. In this case the bottom of the shell had become corroded, where it rested on the ridge of brickwork separating the two flues, to such an extent, that in many places not an eighth of an inch of sound metal was left. The boiler had given signs, by excessive leakage for several months, that the bottom was in bad condition, and it had been patched, but no investigation of it by any competent person had taken place. *Had the boiler been tested in its place by hydraulic pressure to 30 lbs. on the inch, the accident would never have happened, two lives would have been saved, and the proprietor would have been several thousand pounds the richer.* Such a scene of devastation as it occasioned it has never been our lot to witness before. Similar explosions have taken place at Burnley and Worcester, during the last few days, in both of which we suspect shortness of water will prove to have been the cause.



BEET SUGAR FACTORY, BY M. DEWILDE.

BEET SUGAR MANUFACTURE,

WITH PLANS OF SUGAR WORKS, AS CONSTRUCTED BY M. DEWILDE, ENGINEER.

Translated for *The Artizan* from the French of M. Armengaud Ainé.
Illustrated by Plates 11 and 12.
(Continued from page 150.)

The Crystallisation.—The syrup having heen run into the coolers, X X, is well stirred, in order to mix and equalise the various batches of sugar. The room is kept at a gentle heat, in order to preserve the fluidity of the syrup necessary to crystallisation, and in this room the moulds are filled by the workmen.

After heing stirred, the syrup is allowed to cool down to 75° or 60° centigrade, during which the hottom and sides of the coolers become covered with small crystals, which have hut little consistency. The grain is then formed, and the filling can he commenced.

The syrup is poured into large moulds, *q*, formed of earthenware, galvanised iron, or copper painted or tinned. Metallic moulds require great care in their use, and sometimes spoil the sugar, in spite of the paint with which they are covered. Copper tinned appears to he the best material, if it is not too expensive. It was formerly the custom, says M. Payen, to put the moulds to drain into pots, into which their points were inserted. This arrangement being inconvenient for collecting the drainings, and expensive in hand labour, has heen replaced by large frames, into which the moulds are inserted. Below these frames is a zinc gutter, which carries all the molasses drained off into special reservoirs, whence they can be taken to be reboiled, either at once, or after being mixed with water to facilitate their decoloration by the charcoal. They then concentrate them a little farther than the first time, and obtain crystallisable sugar from the second round. They can, hy using the drainings from the second sugars, ohtain sugars of the third round, the crystallisation of which often takes three or four months. They are often compelled, in order to extract the molasses from these sugars, either to finish them, or to put them through the refining process, to submit them, wrapped in cloths, to considerahle pressure.

The extraction of the molasses is usually effected on a floor placed in the roof. The monlds are carried up by a windlass or "lift," worked by steam power. The drain gutters are arranged along the huilding, and the molasses are conveyed by a copper pipe, a^2, to the general receiver, B^2, whence they undergo a second, and sometimes even a third treatment.

A trial is now being made at the factory of M. Pérot, at Villette, of a vacuum-process for extracting the molasses. The ends of the moulds are put into the lid of a box furnished with india-ruhher mouth pieces, which form air-tight joints. On the air being exhausted from the box, the atmospheric pressure forces the molasses through the sugar, not only more rapidly, but more completely.

This idea is not new, for Messrs. Derosne and Cail claim it in a patent of 1845, as belonging to them since 1812. Messrs. Guillaume and Dorey also describe, in a patent dated 1840, a process similar in principle to those of Messrs. Derosne and Cail. Whichever way this may be, the process appears very rational, and only requires the sanction of experience.

The clarifying (or "liquoring," as it is termed here) is the final operation, in order to deprive the sugar of the molasses entangled amongst the crystals. The liquor is water saturated with fine sugar, which will dissolve the molasses but not the sugar, in the moulds. This is poured on the mould, the surface of the sugar being first smoothed down three times, at intervals of twelve hours, and left to drain for three or four days. At the end of this time the sugar is dryer, finer, and less liahle to change than the ordinary raw sugar.

M. Trappe, well known as a sugar-maker, patented, in 1833, an improved method of refining, hy using syrup and spirits of wine together, and by cooling the "liquor" by a pneumatic refrigerator. The use of this apparatus is to prevent the liquor changing colour and deteriorating, whilst standing in the reservoirs.

We ought not to omit to mention the process of M. Lecointe, who obtains a white sugar without refining. The raw sugar, prepared in the ordinary method, is whitened in large moulds by means of *terrage*, which consists in pouring on the loaf of sugar syrup saturated with white sugar, which, in filtering through, expels the coloured syrup. The sugar is then removed from the moulds, crushed, and passed through a metallic sieve, and finally put into small moulds well filled. The moulds are then reversed on a hoard which will contain a dozen or fifteen loaves. These are put in the stove, and hy next day acquire sufficient consistency to admit of their being handled, and put on shelves like loaves undergoing refining. Three or four days after they may be finished. This process appears to involve a good deal of hand-labour, and the colour is perhaps not so white; hut, according to M. Dumas, experience proves it capable of yielding good results.

After the loaves are clarified, they are cut in halves. The heads are put in moulds over pots, to finish draining, and the other halves are placed on their base, to finish drying. As soon as they are well dried, they are assorted, and the grains of sugar taken out.

The residue of the first crystallisations and the clarifyings, after being reboiled and drained, give a second produce, which, in its turn, gives a third, which is sold, unclarified, as an inferior quality. The process may he repeated, to the third or fourth operation; hut, in general, they cease when the drainings mark 34° of density by the hydrometer. They are then no longer crystallisable.

OF THE BOILERS AND STEAM-ENGINE.

The steam necessary for the work, in supplying the engines and the defecating and evaporating pans, is generated in four boilers, K, of a total force of 80 horse power. As will be seen in the transverse section, fig. 4, pl. 11, they are cylindrical hoilers, with two tubes under. They are connected by a steam-pipe, and are each provided with a separate stop-valve. The condensed water from the pans is carried into a cylindrical tank over the boilers, and from which the boilers are fed.

The steam-engine, C^2, is of the direct-acting variety, the cylinder heing holted down on the sole-plate, whence rise two columns to support the crank-shaft. The steam is worked at high-pressure, and expansively, without condensation. The works are supplied with water from the tank, I^2, which is filled from the well C^1, hy means of pumps worked by the steam-engine.

COST OF SUGAR-FACTORY.

The sugar-factory, represented in plates 11 and 12, is designed to operate on 500 hectolitres (2,200 hushels) per 24 hours, which corresponds to about 2,500 kilog. ($2\frac{1}{2}$ tons) of sugar per day, estimating the produce at 5 per cent. only.

The following are the approximate prices of the principal items :—

Twelve-horse engine (without boiler)	£375
Clutches, pulleys, and shafting for working rasps, press-pumps, and washer	83
Two well-pumps, with clutches and fly-wheel ..	125
Four steam-boilers (weighing about $6\frac{1}{2}$ tons each), with valves, &c.	1,008
Furnace-mouths, bars, dampers, &c.	60
Four stop-valves in cast-iron and hrass, with pipes ..	25
Four feed-cocks, with plungers and pipes	17
Two condensed water-cisterns, with cocks	42
Washer and shoot, to conduct roots to rasps ..	33
Rasp of fonr cutters on cast-iron plate, and cast-iron vat for pulp	83
Carried forward	£1,851

Brought forward	£1,851
Spare drum for rasp, with knives	33
Revolving table, with power to press bags of pulp ..	63
Six hydraulic presses	208
Pumps for working presses	250
Four defecating pans, with copper bottoms, containing 353 gals. furnished with admission and exhaust-cocks	333
Six filters of sheet-iron, with two grates and discharge and ball-cocks	221
Four evaporating pans, with coil, covers, and discharge-cocks	250
Three scum presses	62
A scum carriage, furnished with cock and grate ..	6
A vacuum pan, with air-pump and condenser ..	625
Two copper boilers, with double cast-iron bottom ..	100
Two juice lifts for defecation and filtrage	50
Steam pipes, with cocks	146
Three juice vats of wood, lined with copper	19
Steam pipes for heating refining-rooms	166
Pipes to carry steam to evaporating-pans (copper) ..	25
Total, say	£4,819

(To be continued.)

AGRICULTURAL ENGINEERING.

(Continued from page 168.)

No question is more open to discussion than the relative advantages of fixed and portable engines for agricultural purposes. We believe that it depends more upon the size of the farm and the extent to which machinery is employed, than anything else. Where one engine only is employed, it should be a portable one, but on large estates a stationary engine may also be employed to grind, saw, pump liquid manure, &c. To show what arguments are used on either side, we quote the following from a paper by Mr. Ritchie, who advocates fixed engines:—

"What object can be obtained by locomotion to a farmer of ordinarily prudent habits of management, in the present state of husbandry, the writer is at a loss to comprehend. If threshing stacks in the field be the manner in which the farmer conducts his business, no doubt removing the engine from field to field may be a lazy expedient, and in some cases may prove convenient; and where a portable farm railway is used, it will be easily transported. No doubt, in England, threshing in the field is extensively adopted, and is more common than the more economical plan of threshing at the homestead, and having the threshing-machine established in the barn. In some parts of England, the occupier of a large farm prefers having several barns at different parts of a farm to having them all placed in one central position near his dwelling-place, on account of the saving of cartage; and hence, for such an arrangement, portable machines may be valued. But is the mere threshing of a rick the summit of a farmer's ambition? and is he not yet alive to the great advantages arising from the capabilities of the fixed farm engine being applied to a great variety of useful purposes, which the experience of every year is immensely increasing?

"It seems unnecessary to notice the inconvenience of threshing in the open air, in a climate such as this, and the injury the grain must sustain. It is a well-ascertained fact that the ancients, even in the better climate of Italy, could not dispense with a covering for their threshing floors in the open field, and sometimes a covered place was used for the corn, contiguous to the threshing-floor. It was reserved, it seems, for the modern Britons to exhibit the advantages of steam-engines and threshing-machines, that will thresh grain, as of old, in the open fields, and to dispense with the storing of stacks in the rick-yard, and with a barn and granary altogether! But what a waste of labour as well as loss of grain is incurred by this plan! The portable engine, after all, is not so very portable, its weight not being so very inconsiderable as to make it easily moved and transported. It can be moved without a railway on a hard road; but upon a soft farm-road, and still softer field, its removal is an operation of no inconsiderable magnitude and difficulty, as it takes even several horses to move it upon a common road."

Mr. Ritchie then notices and describes the several forms of portable engines, the use of which in England has now become so very common. He considers them very useful for small farms, where they are employed to supersede the laborious and injurious use of horse power and the flail; but asks, What comparison can be drawn between them and the palpable advantages of a stationary threshing-machine? He points out a common error in the application of the portable engine—that of performing the work quickly in place of perfectly, whence arises loss of grain, and imperfection in the shaking process.

"Some millwrights," he says, "chiefly in the west of Scotland, have recently attempted to introduce portable threshing-machines on a large scale, with elevators. Their bulky construction does not admit of their being moved from place to place, and hence they are more adapted for the barn than the field; and to call them portable is a misnomer. These machines are made with cast-iron framing, are sometimes termed the peg-drum beater, and made with the common drum beater, 2½ inches broad, armed with a double row of iron pegs about 2 inches long, the drum working downwards, as in Atkinson's patent peg machine. There is usually one shaker in these machines. The fanners and riddles are placed on the top, and the grain is lifted to them by elevators, and is received, when dressed, at the bottom. The ability of a machine of this description, however compact, is hypothetical. It must be chiefly advantageous for small farmers, in cases where the machine cannot be conveniently incorporated into the farm buildings. The expense of a machine of this kind varies from £56 to £65; and for small farms, from £25 to £35 for 2-horse power. With respect to the advantages or disadvantages of the common and peg-drum beaters, the subject has been already discussed in the Society's transactions for October, 1849, and it is unnecessary to enter here upon it. The writer there gives the preference to the peg-beater machine over the common-beater and the patent peg-drum."

With this we may contrast the arguments advanced by Mr. Philip Pusey, the eminent practical agriculturist, in his capacity of chairman and reporter to the agricultural jury of the Great Exhibition.

"If a farm be a large one, and especially if, as is often the case, it be of an irregular shape, there is greater waste of labour for horses and men in bringing home all the corn in the straw to one point, and in again carrying out the dung to a distance of perhaps two or three miles. It is therefore common, and should be general, to have a second outlying yard. This accommodation cannot be reconciled with a fixed engine.

"If the farm be of a moderate size, it will hardly—and if small will certainly not—bear the expense of a fixed engine; there would be waste of capital in multiplying fixed engines to be worked but a few days in a year. It is now common, therefore, in some counties, for a man to invest a small capital in a moveable engine, and earn his livelihood by letting it out to the farmer.

"But there is a further advantage in these moveable engines, little, I believe, if at all known. Hitherto, corn has been threshed under cover in barns; but with these engines and the improved threshing machines, we can thresh the rick in the open air at once, as it stands. It will be said "How can you thresh out of doors on a wet day?" The answer is simple—Neither can you move your rick into your barn on a wet day; and so rapid is the work of the new threshing machines, that it takes no more time to thresh the corn than to move it. Open air threshing is also far pleasanter and healthier for the labourers, their lungs not being choked with dust, as under cover they are; and there is, of course, a saving of labour to the tenant not inconsiderable: but when these moveable steam engines have spread generally, there will arise an equally important saving to the landlord in buildings. Instead of three or more barns clustering round the homestead, one or other in constant want of repair, a single building will suffice for dressing corn and for chaff cutting. The very barn floors saved will be no insignificant item. Now that buildings are required for new purposes, we must, if we can, retrench those buildings whose objects are obsolete. Open air threshing may appear visionary; but it is quite common with the new machinery; nor would any one perform the tedious manœuvre of setting horses and men to pull down a rick, place it on carts, and build it up again in the barn, who had once tried the simple plan of pitching the sheaves at once into the threshing machine."

We confess we think Mr. Pusey's argument the more cogent for the great majority of cases; and, to put the matter in a clearer light, we will give our notes of the method of applying steam power on the estate of Lord Willoughby d'Eresby, at Grimsthorpe, and the farm of Mr. Mechi, at Tiptree Hall, both of which we have lately visited and minutely examined.

At Grimsthorpe there is a mechanical shop, which supplies the wants of the whole estate. Power is supplied by a portable engine, constructed on the most approved locomotive principle at Swindon, under Mr. Gooch's superintendence. This engine drives a corn mill, a heavy timber frame, a deal frame, a cross-cut saw, a circular saw, and gutter-making machine, drills for making gates, a circular saw for stone, and a reciprocating saw for the same purpose, and other minor machines. The whole of the wood and stone work for building and repairing the cottages on the estate is thus prepared under cover, and, owing to the variety of the machines, there is always work for some of them to keep the hands going. In fact, there is quite sufficient to keep a fixed engine going, but the portable engines offer the advantage of being able to be taken to the surrounding farms to thresh at a time when there is a great demand for their services. They are also employed in ploughing, as we have already noticed,* but with a vastly improved effect, as the following extract from a report by Mr. W. Keld Whytehead, C. E. (recently published in the *Illustrated News*), shows.

"In the present improved arrangement two engines are employed, one at each end of the field, as represented in the sketch, the capstans being attached to the engines. The ploughs are made double-ended, and are drawn alternately by each engine along the field, so that, whilst the rope is being wound upon the capstan of one engine, it is being unwound off the capstan of the other, and *vice versâ.* Each engine, as it is alternately idle, is moved along a temporary tramway, formed of planks laid along the side of the hedge. To prevent the rope dragging in the furrow, six small wooden frames are dropped into the furrow, and provided with rollers, over which the rope runs. Two ploughs are arranged together, each turning a furrow of nine inches. With a field 180 yards long between the engines, the ploughing of each furrow 18 inches wide occupies $2\frac{1}{4}$ minutes, the ploughs moving at rather less than $2\frac{3}{4}$ miles per hour. Allowing for the time lost in shifting the plough, this gives four acres per day at the present slow speed, which I see no difficulty in increasing to four miles per hour, when the men, who are only agricultural labourers, shall have acquired greater dexterity in managing the engines and ploughs.

"To produce this result, there are required two men to drive engines, four to shift ploughs and engines, one to hold plough, and three boys at trucks, and $7\frac{1}{2}$ cwt. of coke. Taking the wages of men and boys at 12*s.* per day, and the coke at 8*s.*, or total 20*s.*, the cost per acre will be 5*s.*, which is about one-half the cost of ploughing by horse power, with the advantage of doing it in half the time. In estimating, however, the pecuniary advantages of steam-ploughing, it must be viewed in connection with a general system of farm machinery."

Here, therefore, there is a case where a fixed engine would present no advantage, because the saving of fuel effected by its use over that of the portable engine would not pay for the cost of the latter, which must be had in any case.

Mr. Mechi's farm buildings are arranged with reference to a fixed engine, which is of 6-horse power, and drives a threshing machine, millstones, chaff-cutters, oat bruisers, &c., and, above all, two liquid manure pumps.

A circular brick tank is sunk in the ground, as near the engine as convenient; the sides are only half-brick thick, set in cement, with puddle behind; the roof is domed over. Into this tank is led all the drainings from the stables, piggeries, cow-houses, &c., and anything and everything that can turn into manure. The contents of this tank (which Dickens calls "the stomach of the farm") are stirred up by a blast of air, driven through a perforated pipe, and diluted with an ample supply of water. Pipes are laid to the centre of each field, where a stand-pipe and stop-valve is provided. To this stand-pipe, a gutta percha hose, 200 yards in length, is attached, and as the stream is delivered with sufficient force to carry it 60 yards more, it is obvious that each stand-pipe will irrigate an area of 520 yards in diameter.

The advantages of this plan are—First, that the food is delivered in such a state that the plant can *immediately* imbibe it, so that the capital invested in the manure does not lie idle for a day. Secondly, the mere irrigating effect of the water is very advantageous. Thirdly, all loss of strength in the manure, from keeping it in heaps, is avoided. Fourthly, the labour and expense of carting the manure out is saved, and the poaching of the land avoided. As to its effects, the cabbages, mangel-wurzel, &c., speak for themselves; the former, especially, are of a size and solidity which is perfectly marvellous. The capital sunk in pipes and hose is about £4 per acre, which, rather curiously, comes to almost the same figure as at Liscard Farm (*vide* p. 106), where the expense for serving 150 acres is £672. Deducting £60 for use of steam-engine, we have just about £4 per acre.

(To be continued.)

* *Artizan*, vol. 1850, pp. 80, 227. For expenses of threshing by steam, see pp. 46, 71, and 252, vol. 1850.

ARMAN'S PATENT SYSTEM OF SHIP-BUILDING.

We have so often discussed the comparative merits of wood and iron vessels, that we need not now reproduce the arguments used on either side. In spite of all the objections urged against them, iron vessels are steadily and rapidly increasing in number. Their corrosion, and the fouling to which they are subject, renders their use less advantageous in tropical climates; and it has therefore been proposed to sheath them with wood, and otherwise to use a combination of wood and iron, which should possess the advantages of both materials, and the evils of neither. Messrs. Jordan and Getty, of Liverpool, and our correspondent, Mr. Poad Drake, have both patented the use of iron ribs and wooden sheathing; and some vessels have been built by the former gentlemen. The principle has been still further carried out by Messrs. L. Arman and Co., of Bordeaux, whose representative, Mr. J. J. Brunet, of the Canal Iron-works (Messrs. Seaward and Co.'s), London, has favoured us with a description of their plans, from which we extract as follows :—

Being fully impressed with the above important facts, Messrs. L. Arman and Co., experienced shipbuilders of Bordeaux, have brought forward a plan for the construction of long sharp steam vessels, in which they extensively employ iron, but which, they confidently believe, is entirely free from the evils above pointed out, and which, nevertheless, combines all the important advantages of freedom from fouling, the durability of the ordinary timber-built vessels (copper-fastened and coppered), with the strength, rigidity, and comparative lightness of iron-built vessels. The plan, in fact, unites the two modes of building; that is to say, the outside part of the vessel, in contact with the water, and exposed to the weather, is a timber-built vessel, while internally it is an iron vessel. For instance, in a vessel built on this plan, a framing of timber of the usual form, but of considerably reduced scantling, is prepared; on the outside of this timber frame the wood planking is secured in the common manner, copper-fastened or coppered, as may be judged advisable; inside the timber framing is introduced a second framing of iron, the ribs of which are formed of iron, rolled in a shape somewhat like the letter Z. The iron ribs are not placed vertically, but diagonally, about two or three feet apart, crossing the first framing at an angle of about 45°, and bolted to the timber frame at every crossing, something similar to the plate-iron riders frequently adopted in timber-built ships. The lower ends of these iron ribs are continued forward or aft, so as to

connect them with and form a part of an iron kelson, introduced for that purpose. Iron shelf-pieces, clamps, beams, &c., &c., are also used, as in iron-built ships; so that, in fact, the inside is, to all intents, an iron vessel.

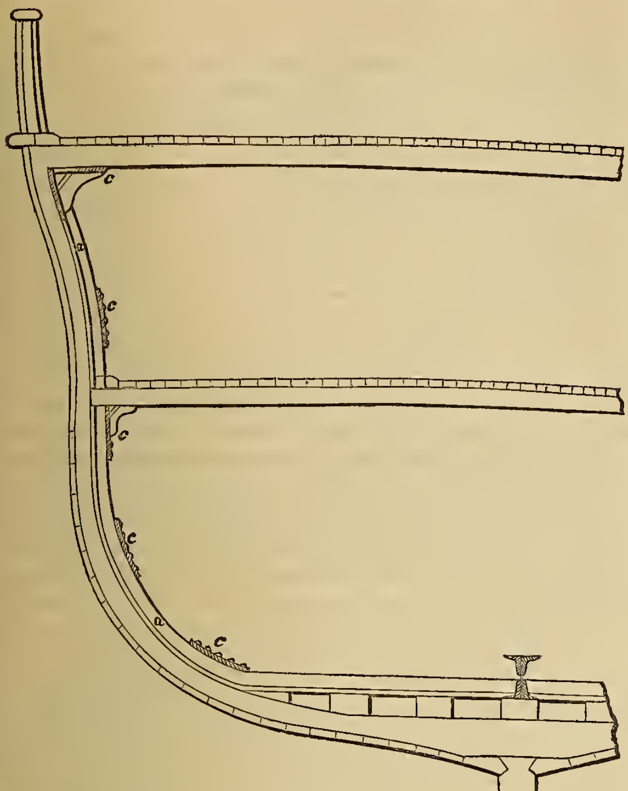


Fig. 1.

Longitudinal plate-iron strakes are plated or riveted to the inner surface of these iron ribs, at different heights, dividing equally, or nearly so, the distance between the under part of the beams of the main deck and the floor timbers, leaving thereby spaces or interstices which fully expose to view both the iron and wood framing, as also the inside of the wood planking, so that a leak may be easily found out and remedied, without injuring or destroying any part of the hull.

To prevent any portion of the cargo finding its way into these interstices, they may be covered over with moveable or sliding panels, composed either of wood and iron.

In the year 1851, Messrs. L. Arman and Co. built on this plan a steamer of 120 horse power—the *General Castilla*—which so completely fulfilled the high expectations entertained of Mr. L. Arman's new mode of building, that the French Government appointed a commission to examine this new construction, and report thereon; and Mr. Sabattier, a naval engineer, expresses himself in these words, addressed to M. de Chasseloup-Laubat, minister of the naval department:—

"The hull of this vessel [*General Castilla*] is lighter than that of any of the mail packets of 120 horse power, having the same dimensions; and M. Arman has certainly succeeded, by his combination of wood and iron framings, in making it much more rigid and solid.

"The draught, here annexed, will explain clearly the system adopted by this gentleman; and a few explanations of the mode of construction of the said vessel will show all the advantages of his plan. Fig. 1 is a transverse section, and fig. 2 an elevation of the inside of the vessel.

"The timbers of packets for 120 horse power are, for the floors, moulded $6\frac{1}{4}$ inches, and $8\frac{5}{8}$ sided, and 4×6 inches at the gunwale.

"Mr. Arman has reduced the scantling of these frames to $4\frac{3}{4}$ inches, from the floor timber to the gunwale.

"The distance between the timbers is $6\frac{1}{4}$ inches, and he introduces alternately a pair of ribs, and then two single ribs.

"When his timber frame is formed, he brings in his filling-in pieces for the bottom, bolts the frame with the keel, and substitutes for the wooden kelson an iron kelson of nearly 13 in. high, and nearly half an inch thick.

"This kelson is fastened to the timbers by rag-bolts, and to the filling-in pieces by fore-lock bolts.

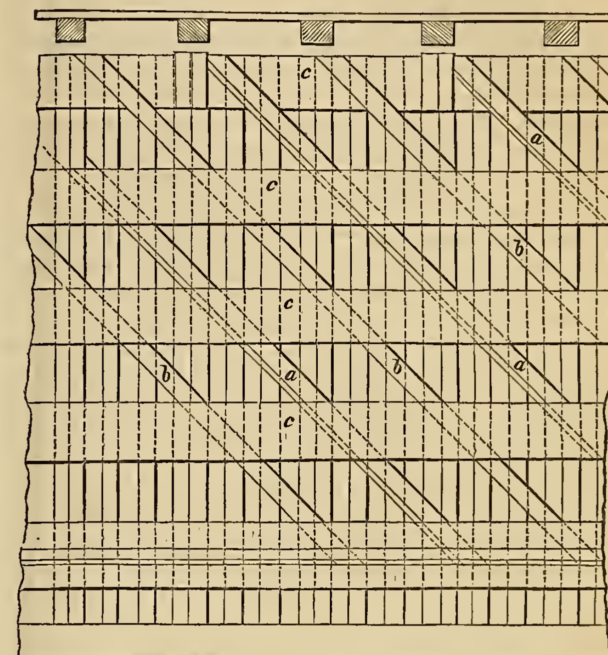


Fig. 2.

"Then, beginning about midships, and proceeding fore and aft, he crosses this timber framing by a second framing of $2\frac{3}{4}$ double angle-iron, *a a*, riveted back to back, in the shape of the letter Z, extending from the under part of the deck to the iron kelson, to which it is fastened, and forming the sides of the iron kelson aforesaid. These iron ribs are fastened by one or two galvanised iron bolts on each timber, which they cross at an angle of about 45°, *and clinched on the outside.*

"These iron ribs are 4 ft. 7 in. apart, and between and parallel to them, a light wooden piece $2\frac{3}{4} \times 5\frac{7}{8}$, *b b*, is made fast on each of the timbers.

"Iron shelf-pieces and clamps, *c c*, are substituted for those of wood, and fastened to the framing, as done in iron vessels.

"The beams are of iron in the engine room, and of wood towards each end.

"The engine room is separated from the other parts of the vessel by iron bulkheads, fastened to the timber frame by angle-iron.

"The stiffness of the vessel is also increased in this part by four iron riders, extending from the main beams to the iron bearers, establishing thereby a connection between the different parts, and giving to the whole a great solidity.

"The engine and boiler bearers are of plate and angle-iron; fastened on the timber framing, *with bolts clinched outside, previously to the fastening on of the outside planking.*

"When these framings are properly fastened, as well as the engine bearers, and the iron riders above mentioned, they proceed with the outside planking, wales, &c., which are copper-bolted on the timber framing only, the bolts being clinched inside as usual.

"When the outside planking is securely fastened, and the whole has been well painted, three longitudinal strakes of plate iron are riveted

on the inside surface of the iron ribs, dividing equally, or nearly so, the distance between the shelf-pieces and the lower floor-heads.

"Interstices are left between these plate-iron strakes, which fully expose to view the double framing, which may be kept in order and painted, so as to last longer than usual.

"This important point constitutes one of the greatest advantages of Mr. Arman's plan.

"The engines are perfectly steady on the iron bearers, and during our trials at sea not the smallest vibration or play could be discovered in any part of this double-framed vessel.

"*We may therefore say that this plan of building combines all the rigidity and solidity of iron-built vessels, with all the advantages of timber-built ships.*

"Repairs of all sorts will present less difficulties than usual; and should it be necessary at any time to remove any of the iron ribs, coach screws may then be advantageously used in refixing them.

"In conclusion, we may say, that sea-going vessels built according to Mr. Arman's plan are lighter and stronger, though not dearer, than those built according to the old system. It is therefore most important to the French navy that a trial should be made, and that one of the vessels that are ordered should be built on this plan."

The Committee for Inquiries in Naval Affairs, who had also received Mr. Arman's communication upon the same subject, appointed one of their members, Mr. Charner, now a rear-admiral, to report upon the information forwarded by Mr. Sabattier, the naval engineer above mentioned. Mr. Charner, after having reported in favourable terms upon the description entered into by Mr. Sabattier, adds:—

"We questioned whether a vessel constructed on this plan would not run the greatest dangers, should it be struck by a shot near the water-line; and whether the destructive effects on the double wood and iron framing, and the outside planking, would not cause so large an opening as could not be easily stopped.

"Mr. Arman's answer was, that the iron framing might be then partly torn and bent by the shot; but as the outside planking was fastened only on the timber framing, and quite independent of the iron ribs, the opening through the side would not be larger than in a common timber-built vessel.

"We are inclined to be of his opinion."

Mr. Auriol, naval engineer, subdirector of naval constructions at Rochefort, also reports as follows:—

"The plan we adopted at Rocheford, under the direction of Mr. Hubert, in the year 1840, for the framing of the steamer the *Gomer*, and which has been followed ever since by order of the minister for the navy, in all the government yards, is particularly remarkable for the strength imparted to these steamers.

"The *Gomer*, for instance, ran aground three times; and remained several hours fretting among rocks. When set afloat again, she resumed her long voyage, and returned to Rocheford the following year, without the smallest leak, and without any change of form, though she lost part of her keel, and the whole of her false keel.

"The timbers are smaller in the *Gomer* and other steam frigates than those previously used for vessels of that size; therefore her solidity is attributable to the diagonal planking and to the iron riders that cross them at an angle of 45°.

"The weight of the hull is equal to nearly 43 per cent. of the total displacement, without any fittings, and 46 per cent. with all her fittings.

"A shipwright of Bordeaux, Mr. Arman, has ventured upon a bolder step, in the construction of a small steamer just launched.

"This steamer's displacement is of 460 tons, whereas the weight of her hull is only 160 tons: 35 per cent. of her displacement, viz.:—*

"Timber framing	60 tons.
Outside oak planking	40 ,,
Decks and fittings	24 ,,
Plate and angle-iron	16 ,,
Total	160 tons.

"This vessel is nearly 153 feet in length at the water line.
,, ,, 20 feet 9 in. in breadth outside the planking.
,, ,, 9 feet mean draught of water.

"Beam engines and common flue boilers.

"Engines and boilers with water.. ..	140 tons.
Coal, for seven days' consumption ..	100 ,,
Freight	25 ,,
Masts, spars, and spare gear	25 ,,
Provisions	10 ,,
Total	300 tons."

* The *General Castilla* was a vessel of a very limited draught of water; in large vessels Mr. Arman has succeeded by his new mode of building in bringing down the weight of the hull to 30 per cent. of the total displacement.

Messrs. Arman and Co. have already built the *Castilla* and the *Messager*. They are now finishing a vessel of 2,400 tons, and a clipper of 700 tons, whilst their success has induced the French Government to build the corvette, *La Mégère*, of 220 horse (auxiliary) power. It will be a long time, we suspect, ere our Government will test any plan which does not emanate from themselves; but we doubt not that private enterprise will be forthcoming on this, as on all other occasions where our national commerce is concerned.

COTTON MECHANISM AND ITS INVENTORS.

In last number we attributed the invention of the "Patent Feeder" for carding engines and blowers to Mr. Mason, who had furnished us with a notice of it. We are requested to state that the inventor was John George Bodmer, Esq., the eminent machinist from Switzerland, of whom, and his numerous ingenious inventions, our readers have doubtless heard. We have to apologise to the representatives of Mr. Bodmer still in this country, for the mistake we have made in this matter; it must be attributed entirely to us, not to Mr. Mason, who merely furnished us with the sketch, presuming on our knowledge of its inventor. Mr. Bodmer brought out this invention while in the establishment of Mr. Hugh Birley, of Manchester.

The "Coiler" to "carding engines" and "drawing frames," is the invention of Messrs. Tatham and Cheetham, of Rochdale, and the "Consolidator," in the double-beater lap machine, that of Mr. William Johnson, of Farnworth, near Bolton. The "Plunger," that of Mr. James Hill, of Stalybridge.

New Carding-Engine.—It is rumoured in Manchester, that five gentlemen, of whom one played an important part in the Great Exhibition of 1851, have purchased the patent right of a cotton carding-engine, for the sum of £30,000, each subscribing £6,000. Our readers can judge of the importance of any cotton machinery from this fact alone. By some, the inventor may be considered very fortunate in obtaining such a sum for an untried invention—at least, publicly untried; nevertheless, he may be thus *disposing of a handsome, or rather a colossal, fortune*, compared to which, the sum he now obtains may be but a "mere drop in the bucket." Any machine promising to effect a saving in textile productions is sure to meet with a large demand, and if judiciously introduced, the demand leads to fortune. Not a few have been *made* by a successful invention in textile machinery. We trust that an opportunity may soon be afforded us of illustrating this—apparently—valuable invention.

Flax-Wool.—We were shown, the other day, what appeared to us to be a lot of wool of good quality, and which, we believe had been pronounced to be so by several good judges in the trade; and right well astonished were we to be told that it was all *flax*, without the slightest admixture of any other fibrous material. If this production can be easily and comparatively cheaply manufactured, it is sure to take a higher place in the rank of commercial speculations than the celebrated "flax-cotton." There is too little

disparity between the price of cotton and flax, to make the cotton—so-called —produced from the latter to be of a high value; not so with wool,—it is a much dearer article than cotton, and likely, from our Australian gold fever, to be still more, so that, if this new material can be successfully introduced, we can see very clearly that a large and speedily-made fortune awaits the fortunate inventor, if he has it properly secured. It seemed a matter hard to be believed that the wool we saw was flax, and nothing but flax. We may anticipate some considerable amount of "jerrying" going on in so-called "real woollen goods." We should like to know more of the properties of this capital "imitation."

Improvements in Bleaching.—We understand that the patentees of a new system of bleaching cotton have, after a long series of elaborate experiments, brought their machinery to such a state of perfection, that they fully anticipate to commence public operations very shortly. The difficulties in the way have been merely mechanical; but these, through the ingenuity of the engineer, who is carying out the plan, have been nearly, if not quite, surmounted. The efficiency of the plan has been well tested, apart from those difficulties, and entirely to the satisfaction of competent authorities. It is expected to make quite a revolution in a certain branch of trade. We have been promised illustrations of it in due time.

ON THE USE OF COAL IN LOCOMOTIVE ENGINES.

The expense of coking the coal to be used in locomotives adds somewhat to the working expenses of railways, and if any system could be devised to remove the objections to the use of raw coal, it would, in many cases, prove of advantage. The smoke produced, the choking of the tubes, and the deficiency of evaporating power, have usually been urged as obstacles; to which may be added, in case of the coal containing sulphur, the rapid deterioration of the fire-box and tubes. On the other hand, many countries possess coal only of that description which will not coke, and they must either use it raw or not at all. The Northern Railway through Bohemia is in this predicament, and the Austrian government in 1849–50 employed a commission to examine and report on the subject. This report, which has appeared in *Le Génie Industriel*, presents the following conclusions:—

1. The substitution of coal or lignite for wood does not necessitate any alteration in the construction of the boiler. All that is necessary is to regulate the admission of air, either by employing thicker bars, or by covering a portion of the grate with cast-iron plates, or by both plans combined.

2. A little preliminary instruction and good will, on the part of the engineers and stokers, is sufficient to make them acquainted with the best method of managing the fire.

3. The substitution requires no change in the service, as the engines get up steam, and keep it as well as with wood.

4. Experience has entirely dissipated the fear of the tubes choking.

5. With judicious management the smoke is not abundant; scarcely visible even, except immediately after firing.

6. The commissioners think that too much stress has been laid upon the destructive effect of the coal on the boiler. The locomotive *Moldau*, on which they experimented, ran 2,400 kilomètres, or 450 miles.

The following precautions are recommended to be adopted:—

1. The coals, and above all, the lignites, require to be properly dried. The desiccation ought, in general, to be carried further, as the coal is more impure. The water, held by the earthy matters which the coal contains, is very hurtful, not only by the absorption of heat which it occasions, in its evaporation, but by its making the coal cake and clog the bars. The coal stores should be raised to protect them from damp, and should be raised to protect them from the sun and rain, and the air should circulate freely around them. With these precautions, eight days is sufficient to render them dry enough. The tenders may also be covered in wet weather.

2. The small should be picked out, and the large reduced to pieces a little less than a man's fist. The trouble will be well repaid. The small may be used for lighting the fires, or for stationary engines.

3. The thickness of coal on the bars should be $3\frac{1}{2}$ to 4 inches. The coals must be thrown on at intervals depending on the steam required; but not more than two or three shovelsful at a time.

4. The proportion which the area for the admission of air should bear to the total heating surface, should be, for coal, ·0018, and for lignite ·00235.

A plan was proposed some years since, by a workman at the central workshop at Malines, for a locomotive to burn coal, and which was also designed to superheat the steam. For this purpose, the barrel of the boiler was entirely filled with tubes, divided into two sets. At the bottom of the barrel one large tube was placed, to carry the flame to the smoke-box, from whence it returned to the front of the boiler into a smoke-box (formed by placing a horizontal water-space over the fire-box), from which it passed to the back of the boiler. The object of the large tube was to permit the deposition of coal to take place in it, in preference to allowing it to choke the small tubes. It, however, completely destroyed that facility of cleaning which characterises the ordinary locomotive boiler, whilst it exaggerated a special defect—the want of steam-room.

Whilst on this subject, we may correct an erroneous impression which M. Couche, professor of the Mining School, appears to entertain, or, at least, we gather as much from the tenor of his remarks. The production of smoke on railways is forbidden in this country by act of Parliament; and it is only therefore on a few lines constructed before the passing of the act, that the use of coal is admissible, under any circumstances, excepting, of course, a perfect smoke-burner can be devised. We remember, when on the Hayle Railway, in West Cornwall, that coal was invariably used, and the smoke appeared to be "drowned" by the steam. No inconvenience was felt, even in open cariages, at the moderate speed (20 miles an hour maximum) employed, nor did the choking of the tubes give any particular trouble.

It appears to us that, to make an efficient coal-burner, the conditions of the furnace must be approximated as nearly as possible to those of an ordinary stationary boiler. This means that slower combustion, and, consequently, larger fire-grate surface, must be adopted than for coke. This enlargement would also have the effect of mitigating the back pressure on the piston, by reducing the power of the blast necessary to maintain combustion. By dividing the fire-box by a water-space *fore and aft*, a double furnace would be formed, which, if fired either side alternately, would also mitigate the smoke nuisance. We may refer on this point to Mr. Zerah Colburn's remarks on the use of coal in American locomotives, *ante* p. 117.

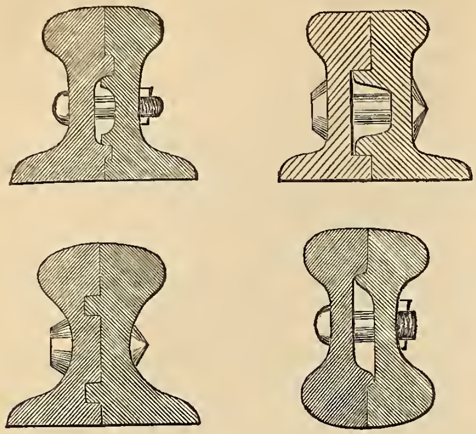
WILLSON'S PATENT COMPOUND RAIL.

The number of plans in use for the permanent way of railways indicates pretty clearly that an extended experience has not yet enabled engineers to decide which plan combines the greatest number of advantages. At p. 147, vol. 1851, we have described all the leading varieties in use in this country: and we have now to call attention to one of American introduction. The engravings show four different arrangements, on Mr. Willson's patent principle, which consists in rolling the rail in two pieces, and then riveting them together, breaking joint in the middle of each. A very perfect "fish-joint" is thus obtained, with greater facility for rolling the rails. By rolling them so as to form a hollow rail, great stiffness may be obtained, with a diminution of the weight.

The following report, by R. G. Benedict, C. E., has led the Great Western Company of Canada to adopt the compound rail for the whole line, and a contract to that effect has been entered into with the Ebbw Vale Iron Company, in Wales.

The following are the more important parts of the report:—

"It is asserted that the advantages of the compound rail over the ordinary T or H rail are, that it has no cross joint, and, as a consequence,



cannot settle thereat, but preserves an even and uniform surface, over which the engines and cars pass without any of that deafening noise or disagreeable jarring motion incident to the use of the T rail, reducing thereby much of the wear and tear of rails and machinery; that no chairs, clamps, or other contrivances are required for securing the ends or joints of the bars; that a saving of three-fourths of the cost of keeping the track in adjustment is realised; that the bearing-surface of the wheels is greater; that higher speed can be maintained with the same power, much less noise, and with far greater safety; and that ten per cent. of power is saved in pulling loads of equal weight.

"This rail is now in use upon the New York and Erie, Hudson River, Philadelphia and Reading, Utica and Schenectady, Syracuse and Utica, Buffalo and Rochester, and the Michigan Central Railroads, and is about to be laid upon several roads now being constructed.

"There are ten miles of it laid upon the Utica and Schenectady Railroad, which has been in use for one year, passing upon the average six or seven trains daily. This rail is not of the improved pattern, but of its performance I refer you to Mr. Vibbard's letter of March 1st, 1851.

"I passed over this rail on the 10th inst., in a hand-car, stopping at various points to examine it, and found that, notwitstanding the service it had performed, it had kept its adjustment admirably; and the track-master informed me that he was never troubled to look after it.

"The Hudson River Railroad Company have five miles of the compound rail laid upon their road between Pokeepsie and Hyde Park. This rail is of the latest improved form, and gives the most entire satisfaction. I was informed by Mr. Higham, the superintendent, that they had not expended a dollar for repairs upon the portion of the line where this rail was used, although the T rail, at both ends of it, required a force constantly upon it to raise track at the joints. The Hudson River Railroad Company have ordered an additional quantity of four miles to lay upon their long bridges, not considering the old rail safe at high rates of speed; and this fact alone is the strongest evidence in favour of the rail, as the president of that road, Mr. Wm. C. Young, has, heretofore, refused to recognise the superiority of the rail until it had been tested by the life-time of ordinary rails. In my last interview with him, he expressed himself decidedly in favour of the rail with its present improvements.

"The Philadelphia and Reading Railroad Company have about three miles of the compound rail in use upon their road; one mile and a half between the Schuylkill and the Delaware Rivers, and a like amount at the Neversink Hills curve, near Reading. These two points are supposed to be the hardest trials that a rail can undergo; as I am informed by Mr. Steele, superintendent of the road, that rails ordinarily last but four years at either place. In both cases the rail is laid upon the loaded track; that between the Schuylkill and the Delaware being upon an ascending grade of 45 feet to a mile, where an assistant engine is used to help the train up; at this place the rail has been laid four months, and has passed 700,000 tons of coal, and more than 4,000 locomotives.

"I passed over the Philadelphia and Reading Railroad on the 17th instant with Mr. Steele, who informed me that the rail remained to all appearance the same as when laid down, with the exception of three or four bars which were badly manufactured. The mile and one half of the rail at the Neversink Hills, near Reading, has been laid down between two and three months, and has passed between 3 and 400,000 tons of coal, and 1,500 locomotives. This rail is also laid at one of the most trying points on the road, it being on a curve of 700 feet radius, and on a grade where the heavy descending coal trains acquire their greatest speed. At this place the rail shows the greatest *wear*, but does not give evidence of any weak points, having retained its position in the curve without the least variation the whole distance. I was accompanied over this portion of the track by Mr. Nicoll, the engineer of the road, and Mr. Millholland, the master machinist, who both testify to the safety of the rail, and the ease with which it is kept in repair.

"Before leaving for the East, I addressed a letter to Mr. J. W. Brooks, of the Michigan Central Railroad, on the subject, and herewith beg leave to lay before you a copy of his answer; it completely covers the whole ground, and it is useless for me to occupy your time in repeating the same arguments used by him in its favour; I believe with him that the adoption of the compound rail by the Great Western Railroad Company will put them in a position to run their road an hour quicker from river to river (228 miles), and with much more safety than with the most improved form of T rail; and that, after the track is ballasted and settled, the expenses for repairs of way, usually so heavy an item, will be reduced nearly three-fourths.

"In addition to this, must be added the saving in the wear and tear of machinery, the saving of fuel, and the increased receipts from business drawn upon the road, in consequence of the speed and regularity attained by the adoptiou of this rail; items that, in themselves, go far towards swelling the profits of railroads.

"There is not a doubt, however, in my own mind on the subject, as I conceive the trial it has had on the Reading Railroad equal to at least five years' wear of it on the Great Western; and the rail is in good order and likely to last out the ordinary life-time of bars used in the same place; and I therefore recommend the adoption of the compound rail for the Great Western Railroad Company."

The following further account of an experience of this rail on the Philadelphia and Reading railway, is given by J. D. Steele, C. E.

"The advantages to be looked for from the general principle of compounding rails are fully set forth in Mr. Latrobe's pamphlet on the subject; extracts from which will be found in Mr. Winslow's late circular, and they need not be repeated by me. The question as to their success or otherwise has turned on the capacity of the rivets to hold the parts together; if it should prove that they are sufficient, or can at any reasonable cost be made so, all admit the advantages of this principle; and if, on the other hand, they fail, as little doubt exists among practical men as to the necessity of rejecting it. The experience on the Philadelphia and Reading Railroad does not thus far indicate any probability of such a failure; the two sections in use are on the loaded car track, and each about $1\frac{1}{2}$ miles in length; the first is on the steep grades between the Schuylkill and Delaware, which, from the employment of an assistant engine upon it, is found to be the hardest part of our road on iron. It has been in use three months, and has passed about 430,000 tons of coal, and seems in as good condition as when it was first put down; one rivet only has failed, which was in the middle of a bar, where there was no strain on it, and was evidently defective when put in. The second section is on the sharp curvature round Neversink Hill, near Reading, where a descending grade in the direction of the trade enables the coal trains to attain an unusual speed. It has been in use one month, has passed 153,000 tons of coal, and is also in a very fine condition, having lost one rivet only, under circumstances precisely similar to that already stated, all the other rivets remaining perfectly good, without apparently having been subjected to any material strain."

GRIMES' STEAM AND WATER INDICATOR.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, to whom was referred for examination a "Steam and Water Indicator," invented by Wm. C. Grimes, of Philadelphia, Penna.—Report:—

That the instrument of Mr. Grimes, which is intended to indicate continually the height of the water and pressure of the steam in a boiler, at any required place at whatever distance from the boiler, consists in two metallic tubes, which are inserted, the one into the steam space, the other into the lower part of the water space, of the boiler, and extend from the boiler to the place at which the indications are required to be made, where the ends of the tubes are brought side by side and connected together by a bent glass tube, one end of which enters each of the metallic tubes. In the simplest form (which is described for the purpose of explaining most simply the theory of the apparatus), the tube connected with the steam space (which may be called the upper tube) enters the boiler at the water line and runs for some distance horizontally, or a little inclined downwards, when it again bends downwards for some inches, and then runs in any convenient direction to the glass tube. The object of this arrangement is to allow the steam to condense in this part of the tube, and to keep the water which fills it always at the proper water level of the boiler. Each of the tubes is provided with a stop-cock near the boiler, and on each of them immediately below the glass tube there is a small hole (called by Mr. Grimes the air-hole), which may be closed by a screw. In order to put the apparatus in working order, the boiler is filled to above the water line, the stop-cocks of the tubes being closed, and a small pressure of steam raised; the stop-cock of the upper tube being then opened a little, the water will enter the tube, and expelling the air before it through the air-hole, will finally begin to run through this hole; the stop-cock of the upper tube is then closed, and the plug of the air-hole screwed in. The lower tube is then filled with water in a similar manner. The apparatus then contains water in the metallic tubes, and air in the glass tube or gauge. If now the stop-cocks on the tubes be opened, and the pressure of the steam increased, the air in the gauge will be compressed proportionably, and the water will rise to an equal height in each branch of the tube; in this way the gauge may be graduated by direct experiment. But the fall of the water level in the boiler will cause the level to fall also in that branch of the gauge which communicates with the lower tube (that is, the tube opening near the bottom of the water space of the boiler), and this will cause the water to rise in the opposite branch of the gauge, in consequence of the necessity of the column of air retaining its bulk. While, therefore, the pressure of steam in the boiler is indicated by the mean height of the columns in the gauge, the fall of the water below its adjusted level will be indicated by the difference of the height of these two columns, provided the level of the water in the boiler end of the upper tube be maintained constant.

In practice this construction is modified by the introduction of another vertical tube, connecting the end of the upper and lower tubes near the boiler. The upper tube is then inserted into the steam space of the boiler, and it leaves the connecting tube at the proper water level, when it runs, as before described; in this way there will be left but a small portion of the upper tube to be filled by the condensed steam. The lower tube is also provided with a blow-off cock between the boiler and the stop-cock before described, to prevent this tube from being choked by sediment. The level of the water in the gauge is indicated by a floating glass tube, coloured and graduated in the inside, and closed in the leg communicating with the upper tube, while a glass ball floats on the surface in the other leg. The difference in the levels of the water columns is then indicated by the position of this ball on the graduated scale of the glass tube in the other leg.

The indicator thus described has been for some time in operation in several steam boilers in our city—especially in the boiler at the office of the *Public Ledger*, where the gauge is brought up into the office, and may be seen constantly in action; and, so far as the committee can learn, they appear to have given satisfaction.

The committee regard the invention of Mr. Grimes as a very ingenious one, and as fulfilling a very desirable purpose, that of indicating the steam pressure and water level of a boiler in the office of the manager of the establishment. They think that it will require an experience of some time to ascertain satisfactorily that the water level of the boiler and of the tube connected with the steam space can be kept constant by the condensation of the steam, but they see no other practical objection to the instrument, which appears so far to have given satisfaction in practice. And as they believe that it will be found to be useful in engineering, and, so far as they know, new, they recommend that Mr. Grimes receive the Scott's Legacy Medal for his invention.

By order of the committee,

William Hamilton, *Actuary.*

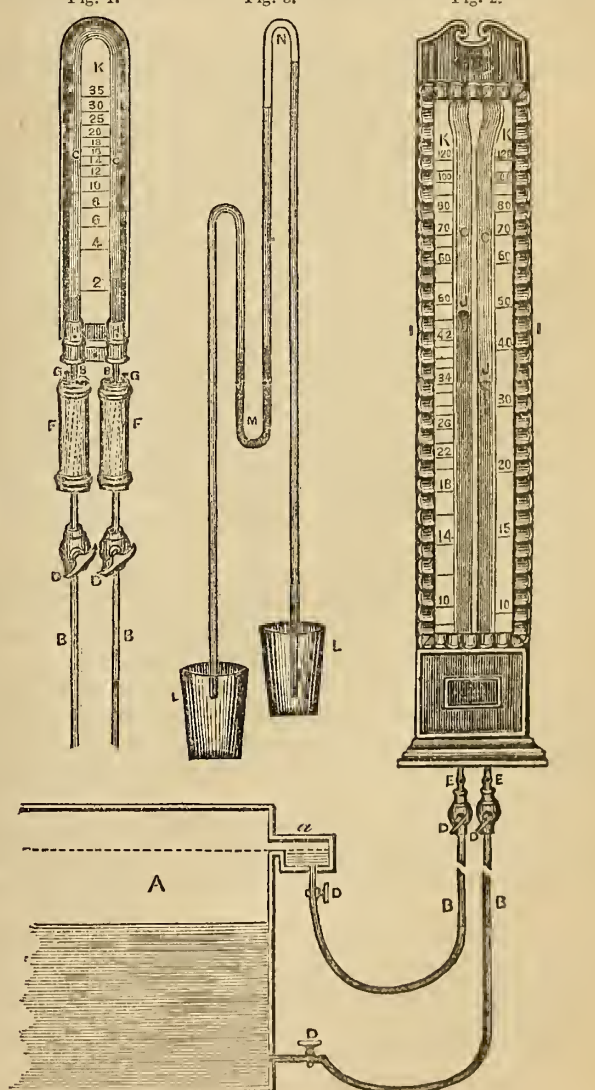
Philadelphia, July 12, 1851.

The figures represent two forms of the instrument, together with an illustration of the principle upon which they act.

The same letters refer to like parts.

A, is the boiler; *a*, reservoir of water; B B, metallic tubes; C C, legs to the glass syphon; D D, the stop-cocks; E E, are screws closing

Fig. 1. Fig. 3. Fig. 2.



apertures in the tubes, which are to allow the air to escape as the tubes fill with water or other fluid. F F, in fig. 1, are reservoirs for containing quicksilver, or other dense fluid; the tubes, B B, both from above and below, extending into the reservoirs nearly to the opposite end of the same; G G, small screws closing apertures in the upper ends of the reservoirs, through which they are filled, and through which the air escapes as the tubes below fill with water; H H are screws closing apertures in the tubes, B B, between the reservoirs, and the glass through which all the air is allowed to escape up to that point. I I, in fig. 2, is a wooden case, inclosing the glass of the syphon; J J, high coloured glass floats, to render more visible the tops of the columns of water that rise in the syphon. An elastic fluid fills the space above the floats. K K, graduated scale plates.

Fig. 3 represents a glass syphon, with the ends of the legs in the cups, L L, of water, for the purpose of illustrating the principle of the instrument. If the syphon is nearly filled with water, with a small portion of air above, as represented at N, and one of the cups be raised or lowered, a corresponding movement will take place at the tops of the columns of water. Or if a quantity of some fluid more dense than water (quicksilver for instance) is placed in the bend at M, and the rest of the syphon filled with water, then the movement of the cups up or down will cause a corresponding movement of the fluids in the syphon, but in a degree diminished in proportion to the density of the fluid in the bend.

COMPARATIVE COST OF WATER AND STEAM POWER IN THE UNITED STATES.

By C. E. Leonard, New York.

It is not our intention at present to endeavour to point out those local advantages which may be derived from the use of water or steam power in any particular location. Our investigations will be confined to those elements in this problem which are purely mechanical; this will be the kind of information which we apprehend the capitalist requires.

We will first ascertain the usual expense of horse power for running the steam engine. We will select a 20-horse power for a medium of the small class of engines, and 200-horse for a medium of the largest class of land engines. It is not, perhaps, generally known that the largest class engines produce power at a much cheaper rate than those of the smallest size; this being the case, it will be necessary for us to present two sets of calculations, one for each class. A 20-horse may be considered a good medium for the small class, and 200-horse for the larger denomination.

It will be shown in the articles on steam power that it will require a 12-inch cylinder engine to give 20-horse power. In this case the pressure of the steam in the boiler will be about 60 lbs. per inch, and the supply of steam to be cut off at about half of the stroke.

The ordinary consumption of coarse anthracite coal of an engine of this size, when working under the circumstances we have named, is about five-fourths of a ton for each 10 hours. This kind of coal is generally worth from 3½ to 4 dollars per ton, delivered at the boilers—say 4 dollars.

It will not require but one person to attend to the engine and boilers, whose wages will be about 9 dollars per week. The small current expenses, such as oil, packing, &c., will amount to about 2 dollars per week.

The cost of running the engine per week will be expressed as follows:—

Coal per week, 5 tons at 4 dollars	20 dollars.
Engineer	9 ,,
Current expenses	2 ,,
Cost to run the engine per week	31 dollars.

This divided by 20 gives 1·55 dollars the cost per horse power per week, or 26 cents. per 10 hours per horse power. This result may be considered a fair average cost of power produced from the small class of engines.

We will now give an estimate on a condensing engine of 200 horse power. It will be shown in the articles on steam power that two 30-inch cylinders will yield this power, the supply of steam being cut off between ⅓ and ½ stroke, and the pressure of the steam in the boiler being from 40 to 50 pounds, or about 45 pounds per inch. It will also be shown that such engines working under these conditions will consume about 4 tons per 10 hours. This engine will require the services of an engineer, fireman, and a labourer. The current expense of oil, packing, &c., will be about 5 dollars per week.

The cost of running this engine per week will be expressed as follows:

Coal per week, 24 tons, at 4 dollars ..	96 dollars.
Engineer	12 ,,
Fireman	6 ,,
Labourer	5 ,,
Current expenses	5 ,,
	124 dollars.

This, divided by 200, gives 62 cents per horse per week, or 10 cents nearly per 10 hours, or less than half of the 20-horse engine.

The theory or reason of this great disparity will be duly explained in the articles on steam power, which will be presented in some future number.

The cost of running each of these engines per year will be—

312	312
20·00	5·20
6240·00	1622·40

that is, 6,240 dollars for 200-horse, and 1,622 dollars for the 20-horse.

Water-Power.—Water companies generally rent their power at a stipulated sum per foot under a given head, and with a certain fall.

The term "head" refers to the distance from the level of the water in the flume to centre of the opening of the gate, when the gate is hoisted to its proper height. The term "fall" is equal to the distance from the centre of the opening of the gate to the level of the water in the race below the wheel.

The term "per foot" refers to the area of the opening of the gate; thus, if a gate is 12 feet in length, and is hoisted 4 inches, then the area of the opening would be 12 feet by 4 inches, or 4 feet area. In this case, there would be 4 feet of water in use.

At present, we shall not have room to compare the cost of steam power with but one of the various water companies which we could select. We shall, however, continue the subject in some future number.

For a comparison, at present we will select the water power at Paterson, N. J.

The whole fall on some of the sites is 21 feet, and the head about 2½ feet. We have first to ascertain how many feet on a fall of 21 feet will be required to give 20-horse power. This fall will allow an overshot wheel about 18 feet in diameter.

We find, in our articles on water power, that, to produce 20-horse power on this fall, it will require 12 cubic feet of water per second. We must now ascertain how many feet will be required to allow 12 cubic feet to pass per second.

The velocity of the water under this head is determined by the following rule:—

Square-root of 2½ (the head)	= 1.58
Constant number	= 5·6
	8 8 feet velocity

of the water under this head. (This rule will be explained in the articles on water power.)

Now, if 12 is divided by 8·8, the result will give $1\frac{1}{3}$ feet area of gate; and if the cost of steam power per year is divided by this result, we shall have the value of the water power per foot; thus:—

$$1{\cdot}363\ )\ 162240$$

$$1191 \text{ dollars.}$$

The value of a foot of water, therefore, on a total fall of 21 feet, when compared with the cost of power derived from an engine of 20-horse, is worth 1,191 dollars per year.

We will now compare the cost with that of the large engine of 200-horse.

It will be shown, in the articles on water power, that the area of the gate will vary directly as the quantity of water discharged. The area of the gate, therefore, for 200-horse power must be deduced as follows:—

$$20 : 1{\cdot}363 :: 200 : a$$

$$200$$

$$20\ )\ 272{\cdot}600$$

$$13{\cdot}63, \text{ or about } 13\tfrac{1}{2} \text{ feet,}$$

number of feet required for 200-horse power. The price per foot will be

$$13{\cdot}6\ )\ 6240$$

$$458 \text{ dollars per foot.}$$

The expense of the power produced by a 20-horse engine was 1,191 dollars per foot. The price of water power at Paterson is 500 dollars per foot.

From these results we see that steam cannot compete with water power at Paterson, unless it is established on an extended scale. If an establishment was to be put in operation, which would require some 150 to 200 horse power to propel it, it would probably be the most economical to use steam power. As water power is now divided up in Paterson, we do not think that steam could be substituted for less than the equivalent of 1,100 dollars per foot, or about double of what it now costs.

[In the foregoing calculation, no account is taken of the interest on the capital sunk in the engine, boiler, setting, chimney, &c., which forms an important item in the annual cost. Nor is anything allowed for repairs and replacement. On the other hand, nothing is said as to the cost of the water-wheel. In estimating the horse power, it must not be forgotten that an approximation to the indicated power is spoken of.—Ed. *Artizan.*]

MANUFACTURE OF STEARIC CANDLES.*

The foundation upon which the manufacture of stearic acid candles is based is the saponification of fats, and the separation of the fatty acids from the soaps, which the beautiful researches of Chevreul have made known to us. It would, however, be an error to suppose that these investigations alone solved the difficulty. Seven years, in fact, elapsed, after the publication of Chevreul's discoveries, before they were successfully applied; but this can be a matter of no surprise to those familiar with the establishment of a new industry, and who are aware of the immense chasm which separates the laboratory of the chemist from the workshop of the manufacturer; they only can comprehend fully the obstacles of all kinds that must be vanquished in order to fructify a purely scientific germ, and render it a healthy and vigorous branch of art.

The first steps in the manufacture of stearic candles were surrounded by difficulties of all kinds, which frequently clouded the prospects of the enterprising inventors. Chevreul's experiments were published as early as 1823, but the idea of making candles from the isolated fatty acids does not appear to have been matured until two years later. At this period Chevreul allied himself with his celebrated colleague Gay-Lussac, with the intention of applying his discoveries to the practical purposes of life. In the year 1825, these two chemists took out a patent in France for the manufacture of fatty acids and their application to the making of candles. Gay-Lussac took out, moreover, a patent in England, in the name of his agent, Moses Poole, on the 9th of June of the same year. The specification of these patents is highly interesting, as evincing a remarkable sagacity, on the part of the patentees, in anticipating the progress of this branch of industry; they call in aid all the agents which have been adopted up to the present day, even including the distillation of fatty acids with the aid of steam, which has only been brought into practical operation within the last ten years. Nevertheless, the proprietors of the patents derived no benefit from them,—the processes which they employed resembled too closely the proceedings of the chemist in his laboratory, rendering their industrial execution too costly. Although lime was specified by Gay-Lussac for the saponification of the fat, the ordinary alkalies continued to be employed; and, for decomposing the soap, hydrochloric acid was used, the alkaline salts of which were never completely separable from the fatty acids. In their French patent, Chevreul and Gay-Lussac even spoke of the necessity of cold and hot alcohol for the perfect purification of the stearo-margaric acid. If we compare this proceeding with the present practice, we perceive that it had yet to pass through various ordeals.

A formidable and unforeseen difficulty presented itself in the fact that the new stearic candles would not burn with the ordinary wick; a long series of experiments were necessary, in order to construct a wick which would not sputter the fat during its combustion. Chevreul and Gay-Lussac succeeded in doing this in the course of 1825, and, indeed, the plan was specified in the English patent before spoken of; they endeavoured to secure their invention in France by a rider to their patent, but this was not done until another inventor had taken out a patent for a similar contrivance.

A discovery like the separation of the fatty acids necessarily excited in many minds the desire for its practical application. Almost immediately after the publication of Chevreul's work, Cambacérès, an *Ingénieur des Ponts et Chaussées,* appears to have directed his attention to the utilisation of Chevreul's investigations; at all events, he took out a *brevet* for the improvement of the wicks of stearic candles, in February, 1825, which was prior to the date of the rider to Chevreul and Gay-Lussac's patent in France, and that of Gay-Lussac in England; the value of the patents of these chemists was therefore considerably reduced. Cambacérès' first plan was a hollow wick; but in May of the same year he patented the plaited and twisted wicks, by which snuffers were rendered superfluous. The tension of the separate threads of the plaited wick causes the portion which rises from the candle to curl outwards, so that its point projects beyond the flame, and is rapidly consumed in the air, that plays freely around it.

Cambacérès had observed that the wicks soon became clogged in the stearic candles, although this did not happen if they were used in ordinary tallow candles; he ascribed this phenomenon to the formation of soaps produced by the action of the fatty acids on the carbonated alkali resulting from the combustion of the wick. Whatever may be the cause, he succeeded in removing the difficulty by treating the wick with dilute sulphuric acid; he supposed that the presence of this acid prevented the formation of soaps, by combining with the alkalies in the ash to form sulphates.

Another essential improvement in this branch of industry was brought about by the introduction of the cheaper material lime, as a saponifying agent, followed up by the decomposition of the lime soap by dilute sulphuric acid. The merit of having *successfully* introduced the saponification by lime (*saponification calcaire*) belongs to De Milly, who has

* Report of the Jury of the Great Exhibition.

earned great praise by his contributions to the stearic manufacture. His plan formed part of the original patent of Chevreul and Gay-Lussac, and it redounds much to his credit that he brought a plan to bear which had failed in the hands of his illustrious predecessors. The saponification by lime, in an industrial sense, dates from 1831.

As the wicks were frequently corroded by the sulphuric acid used according to Cambacérès' preparation, De Milly, in 1836, took out a patent for employing the borate, phosphate, or sulphate of ammonia for the same purpose. These improvements, and the endeavours of De Milly to promote the introduction of the new branch of industry in other countries, gradually caused its extension.

Nevertheless, numerous difficulties still remained to be overcome. The limits of the present sketch will not permit us to do more than give the main features of the development of the stearic manufacture. We are unable, consequently, to trace year by year all the little improvements which have taken place; but we cannot avoid a short notice of the numerous experiments to prevent the crystallisation of the stearic acid during the moulding of the candles. The first attempt was made to introduce another acid, and though successful in its immediate object, the choice (arsenious acid) was an unhappy one, for it almost threatened the very existence of the youthful art. It is true that this deleterious substance was added in very minute quantities, yet it was entirely incompatible with health, and was soon prohibited on the Continent by authority, and in England by equally powerful public opinion. Here commenced all the manufacturer's troubles anew; in all directions he sought a substitute, and found none; at last, after innumerable experiments, and when almost driven to despair, he hit on two expedients—very simple when once found out—which answered as perfectly as the discarded plan. The means now employed are—the addition of a very minute quantity of wax to the stearic acid: a still more common plan is to allow the melted acid to cool down almost to the point of congelation before it is poured into the moulds, which are warmed to the same temperature as the fatty acids. The refrigeration and occasional stirring of the liquid fat produces a sort of liquid pulp, which congeals in the moulds without crystallisation.

Sulphuric saponification (saponification sulphurique). While the stearic manufacture was gaining ground extensively, as we have indicated, a new art sprang up during the last ten years, having the same objects, and being based on the same foundations, but seeking the attainment of the goal by entirely different means—we speak of the saponification of fat by means of concentrated sulphuric acid, and subsequent distillation of the resulting fatty acids.

The origin of this proceeding must undoubtedly be sought in Chevreul's work; still E. Frémy deserves the credit of having, in an important paper, perspicuously exhibited the relations of fats to sulphuric acids. He demonstrated, in a treatise which he published in 1836, that the action of powerful acids on fatty substances has a close analogy to that of the alkalies. Both re-agents decompose the fat; but while the alkalies combine with the fats, and set the glycerin free, the sulphuric acid combines both with the acids and the glycerin; thus we obtain conjugate sulpho-acids, sulpho-stearic, sulpho-margaric, and sulpholeic acids on the one hand, and on the other sulpho-glyceric acid. The first three are of a very ephemeral character; water decomposes them into slightly modified fatty acids, insoluble in water, and sulphuric acid, which, with the sulpho-glyceric acid, dissolves in the water.

To George Gwynne is due the merit of having first described a method of obtaining fatty acids by the sulphuric saponification of neutral fats, and subsequent distillation of the resulting products. In a patent obtained in March, 1840, he describes very fully his proposed plan for effecting this object, which consisted in distilling *in vacuo*, by means of an apparatus similar to that employed in sugar refining; the difficulty of sustaining a good vacuum on the large scale was, however, found to present so many obstacles, that the plan was consequently abandoned.

Mr. Gwynne proposed also to distil, in the same manner, fatty acids obtained by means of lime saponification, and even to obtain fatty acids by the distillation of neutral fats.

George Clark also directed his attention to the practical application of Frémy's experiments. On the 5th November, 1840, he took out a patent for utilising this property of sulphuric acid in decomposing fats, but without having recourse to their subsequent distillation: the difficulty in cost, however, of purifying the fat after decomposition, rendered the attempt unsuccessful, notwithstanding that the quantity of sulphuric acid proposed to be used was only one-fourth the weight of the fat, whilst Frémy employed in his laboratory experiments double this quantity. Further experiments were still necessary to establish on a firm footing saponification by means of sulphuric acid, which ultimately again led to the adoption of an improved system of distillation.

In the patent before mentioned, which Gay-Lussac took out in England, and which is distinguished by its comprehensive treatment of the question, the distillation of fatty matters is spoken of, and the remark incidentally made that the process is much accelerated by the presence of moisture; this part of the specification was, however, never worked.

Nearly sixteen years later, on the 22nd August, 1841, Dubrunfaut obtained a patent in England, and about the same time, likewise, one in France, for the purification of fatty bodies and their distillation. The plan proposed by M. Dubrunfaut was to heat the commoner oils to a high temperature, and to pass steam through them, by which means their disagreeable odorous principle was intended to be removed. The distillation of fatty bodies was also claimed by Dubrunfaut, but the chief object of his patent was evidently the purification of common oils. By decomposing the neutral fatty bodies in this way, acrolein is produced, the vapour of which is so pungent and irritating, both to the eyes and the throat, that no workman can be found to endure it; hence this patent was not successfully worked, yet it contained a germ which, in the hands of Jones, Wilson, and Gwynne, was elaborated into the art now practised.

In an English patent, dated the 8th December, 1842, and granted to William Coley Jones and George Wilson, we find the first application of the combined process of sulphuric saponification and *steam* distillation. They decompose fats with sulphuric acid, aided by heat, and distil the fat thus decomposed by means of steam, which passes in minute streams out of a perforated coil fixed in the bottom of the still.

The combination of the sulphuric saponification and subsequent distillation solved the fundamental conditions of success; nevertheless, a whole series of improvements followed, which essentially contributed to establish the present extension of this system of manufacture.

Patents taken out by Gwynne and Wilson on the 16th November, 1843, and on the 28th December of the same year, secured to them farther improvements in this process; in the latter, a method is described of reducing the quantity of sulphuric acid employed for decomposing the fats to from 10 lbs. to 6 lbs. for every 112 lbs. of fat; that is, to one-sixth, and even to one-tenth of the quantity employed by Frémy in his investigations. This saving was effected by heating the fat to 177° C. (350° F.) Another improvement was the heating of the steam in a series of pipes after it had left the boiler, instead of depending on the temperature of the fat to effect it.

Their last patent on the subject is that of the 30th October, 1844, in which they propose to use a jet of supersaturated steam to heat the fats previous to sulphuric saponification. These patents embody all the plans which, since July, 1844, have been in operation at the works of Price's Candle Company at Vauxhall and Battersea, of which Mr. Wilson is the managing director.

Similar manufactories, though not of such magnitude, have been

established in other countries; the principal are those of Masse and Tribouillet, at Neuilly, near Paris, Motard in Berlin, Bert at Gijon (Spain), and of the Milly Candle Society in Vienna.

There can be but little doubt, after inspection of the candles in the Exhibition, that the process just described is applicable to the production of the higher class of candle, white, inodorous, and dry to the touch; but this is not the only part which it has filled up to the present time, it is in the treatment of palm oil and cheap fatty bodies that it renders most valuable service. By its aid fats the most fetid and impure furnish candles of the finest quality; and thus it utilises the waste of the glue-maker and oily residues derived from the waste lyes of woollen and other manufactories.

We now proceed to describe the practical processes of the workshop, the various stages of which will be followed without difficulty, after what has been said in the article on soap, and in the foregoing sketch respecting the constitution of fats and their decomposition.

(To be continued).

NOTES BY A PRACTICAL CHEMIST.

Photographs on Glass.—Pucher forms a thin film of iodide of sulphur upon plate glass, by covering the glass, which must be very clean, with a very thin coating of sulphur, and then impregnating this for a few seconds with the vapour of iodine. The glass plate is then placed in the camera, where at the same time the vapour of some quicksilver, in an iron cup at the bottom of the camera, acts upon the iodide of sulphur with which it is coated, and it receives the photographic image within a minute. The glass plate, when taken out of the camera, only exhibits a trace of the picture, but this immediately comes out on exposure to the action of the vapour of bromine. If the picture be now held over alcohol, and some of the same liquid poured upon it, it will be fixed. Not more than from five to eight minutes are required for the whole operation. The glass plates must be breathed upon and well rubbed with soft linen rag several times before use. They are coated with sulphur by burning sulphur sticks, made on purpose, in a proper tube, and holding the plates over it at a distance of about three inches. These sulphur sticks are prepared by dipping pieces of rush pith into a melted mixture of sulphur and mastic, with which they become incrusted. For use, these sulphur sticks, which are about the size of a lucifer match, are stuck on a brass needle, introduced into the middle of a glass tube, and kindled, so that the vapour of the sulphur may come in contact with the glass plate held over it.

These glass plates are so sensitive, that the coating of iodide of sulphur becomes instantly changed on exposure to direct sunlight, and gives a Moser's image within five minutes, when laid in a book. The figures thus obtained are most easily read by candle-light. In day-light, the blue letters can be recognised on the yellow ground only by looking through the plate towards the middle of the window, or towards a sheet of paper fastened in that place, the sulphur not having been removed either by vapour of bromine or by alcohol.

If a glass plate, covered with a solution of gum, and exposed to the vapour of iodized sulphur, be placed in the camera, a positive picture, with all its details, is obtained, the outlines of which can be laid bare by an etching-point capable of scratching the glass. If a glass plate, so marked, be rubbed in with printing ink, the outlines will be filled, and the ink will remain in them when the glass is freed from the coating of gum by means of water. The picture is then easily transferred to paper, which is to be laid on the plate, and rubbed over with a paper-knife.

Process for the Analysis of Chrome Ores.—Mr. Calvert proposes the following process:—The ore, well pulverised, is mixed with about three or four times its weight of a mixture made by slaking quicklime with caustic soda, and then drying and calcining the mass. To this, about a quarter of nitrate of soda is added, and the mixture calcined for about two hours. By this method, one treatment is generally sufficient to convert the chromium into chromic acid; whereas, by the usual method, five or six successive calcinations are required.

Another process, which he has also found to produce good results, consists in calcining the pulverised chrome ore with nitrate of baryta, adding a little caustic potash, from time to time, towards the end of the process.

New Alloy for Plates used in Calico-printing.—A white alloy, peculiarly adapted for the plates used in calico-printing, and used for that purpose in Ghent, has the following composition:—

Tin	46·81
Lead	37·44
Bismuth	15·75

Separation of Arsenic, Antimony, and Tin.—Mr. Ansell proposes to dissolve the mixed sulphurets in nitro-hydrochloric acid, and pour the solution into a vessel in which hydrogen gas is being developed. The gases given off are first conducted through a bottle containing solution of acetate of lead, to remove hydrochloric acid and sulphuretted hydrogen, and are then passed into a test-tube half full of concentrated nitric acid. The nitric acid solution obtained, after the gases have passed for about a quarter of an hour, is evaporated to dryness, and the residue, which contains the arsenic, partly as arsenious and partly as arsenic acid, and the antimony as antimonic acid, is exhausted with warm water, which takes up the two former substances, and leaves the latter untouched. The tin remains in the vessel where the hydrogen was evolved. These are now severally detected by the usual tests.

Distinguishing reactions of Arsenical and Antimonial Spots.—Wackenroder has entered upon an examination of Slater's test, which consists in the use of hypochlorite of soda. He finds that it may be used with the greatest certainty in distinguishing purely arsenical from purely antimonial spots, which is the principal point in judicial investigations.

ANSWERS TO CORRESPONDENTS.

"B. A." You will do well to be cautious in following methods given in journals of the merely literary, or "family" class. One of these luminaries advised cottagers to add solution of *chloride of calcium* to the ordinary liquid, in whitewashing their walls. A wall so treated would remain damp for ever. Another recommended the use of the young green sprouts of garden rhubarb as a spring vegetable, regardless of the amount of oxalic acid therein contained.

"Eureka." No, you have *not* found it. The yellow scales you describe are not gold, but merely iodide of lead, a substance which, strangely enough, has led others into the very same error. You will find alchemy a very poor speculation in these days of gold-mining.

S.

ON PRESERVED FOODS.

(From Professor Lindley's Exhibition Lectures.)

In the first place, the Exhibition contained some examples of dried vegetables, prepared by what is called Masson's process. Yonder are specimens, lying to the right of the chairman. They have been packed in tin-foil, and very imperfectly secured; so that, although they are still undergoing no change whatever, yet they are not seen under favourable circumstances; they have been affected, though not injuriously, by the dampness of the building in which they have been kept. The samples consist of white and red cabbages, turnips, Brussels sprouts, and various other things. As to the method of preserving them, it appears to be free from all objections. First, it is very cheap; secondly, as we are led to believe by persons in France who are well informed on the subject, it perfectly answers the purpose. The mode of preparing these vegetables is shortly as follows:—They are dried at a certain

temperature (from 104° to 118°), which is neither so low as to cause them to dry slowly, nor so high as to cause them to dry too quickly; if the last happens, they acquire a burnt taste, which destroys their quality. They lose from 87 to 89 per cent. of their water, or seven-eighths of their original weight; after which they are forcibly pressed into cakes, and are ready for use. I saw, a year ago, the original of a letter from the captain of the *Astrolabe*, a French vessel of war, speaking in the highest terms of the supply of these vegetables for the use of that vessel during her voyage; the French navy generally mentions them in the most favourable terms, and no reason appears for doubting such statements. The specimens before you are, I repeat, seen under unfavourable circumstances. They ought to have been kept in tin, and protected from the air, instead of which, they have been lying about more than nine months in the Exhibition building, where they have been exposed to considerable dampness. Yet they are not injuriously affected, although they are absorbing moisture, as must necessarily happen in a damp place, and which, if it were to continue, would spoil them. Now I think this is a matter of more consequence than it may appear to be, for the following reason; it is usual to supply the navy with preserved food of different kinds, and I am informed by a distinguished officer of the Antartic expedition, under Sir James Ross, that although all the preserved meats used on that occasion were excellent, and there was not the slightest ground for any complaint of their quality, yet the crew became tired of the meat, but were never tired of the vegetables. This should show us that it is not sufficient to supply ship's crews with preserved meat, but that they should be supplied with vegetables also, the means of doing which is now afforded.

I have only a word or two to say about M. Brocchieri's scheme. Those who are acquainted with his proposal will remember that cakes and other articles of food made from blood were exhibited in the building. In some cases those cakes have undergone no change; in others they became putrid. The object of M. Brocchieri was to utilise the blood of animals in abattoirs. Now, as we are led to believe that abattoirs will be constructed in London, it is an important question whether the blood of the numerous animals there killed can be utilised or not. M. Brocchieri thought it could; and by some unknown method he separated the serum from the crassamentum, and obtained a hard, dry substance, the nature of which I can scarcely describe; it was perfectly insipid, and with nothing disagreeable about it whatever. Perhaps it was very like dry black bread, or something of that sort. If the name had not been unfortunate, people would have looked at it with more interest. It is a question, however, whether it is desirable thus to utilise the blood collected in abattoirs, or whether it may not be better to let it go into the refuse, to be employed as manure; for it appears from the best evidence that can be obtained, that blood is admirably adapted for that purpose. It is proved that, supposing unmanured land will yield threefold, then land manured with bullocks' blood will yield fourteen fold; therefore we have direct evidence that the blood of animals has a very powerful action as manure, and it may be more profitable to obtain our food from it in that indirect manner than to use blood-cakes prepared after M. Brocchieri's method.

Preserved Meats are out of favour just now. We hear of little except condemned canisters, which the Admiralty unfortunately have in store. It is the more proper, then, to state that the evidence before the jury went to show that it is possible to preserve meat in canisters without undergoing any change, for a great length of time. We had hashed beef, which was excellent, dating back to 1836; we had boiled beef fifteen years old, preserved in canisters, and many other specimens, none of which were changed. It is clear, therefore, that the canister process of preserving is good, provided you keep a sharp eye on the contractors, and upon those who act under them.

What is more important than all other preserved provisions, is the article to which I must next request attention. A great deal of interest was excited when the contents of the Exhibition first became known,—and it did not diminish afterwards,—by a certain Meat-Biscuit, introduced among the American exhibitions from Texas, by Mr. Gail Borden. We were told that its nutritive properties were of a very high order; it was said that ten pounds' weight of it would be sufficient for the subsistence of an active man for thirty days, that it had been used in the American navy, and had been found to sustain the strength of the men to whom it had been given in a remarkable degree. Statements were made to us, which have since been corroborated, that it would keep perfectly well without change, under disadvantageous circumstances. Colonel Sumner, an officer in the United States dragoons, who had seen it used during field operations, says he is sure he could live upon it for months, and retain his health and strength. The inventor, he says, names five ounces a-day as the quantity for the support of a man; but he (Colonel Sumner), could not use more than four ounces, made into soup, with nothing whatever added to it. The substance of these statements may be said to amount to this, that Borden's meat-biscuit is a material not liable to undergo change, is very light, very portable, and extremely nutritious. A specimen, placed in the hands of Dr. Playfair for examination, was reported by him to contain 32 per cent. of flesh-forming principles, for it is a composition of meat—the essence of meat—and the finest kind of flour. Dr. Playfair stated that the starch was unchanged; that, consequently, there could have been no putrescence in the meat employed in its preparation; and that the biscuit was "in all respects excellent." It was tasted—I tasted it—the jury and others tasted it; and we all found nothing in it which the most fastidious person could complain of; it required salt, or some other condiment, as all these preparations do, to make them savoury. This meat-biscuit, as I said just now, was reported to be capable of keeping well; and this might well be true, because no foreign matter had been introduced into its composition; there was no salt to absorb moisture, and nothing else to interfere with the property of flour, or of essence of meat. These biscuits are prepared by boiling down the best fresh beef that can be procured in Texas, and mixing it in certain proportions with the finest flour that can be there obtained; it is stated that the essence of five pounds of good meat is estimated to be contained in one pound of biscuit. That it is a material of the highest value there can be no doubt; to what extent its value may go nothing but time can decide; but I think I am justified in looking upon it as one of the most important substances which this Exhibition has brought to our knowledge. When we consider that, by this method, in such places as Buenos Ayres, animals which are there of little or no value, instead of being destroyed, as they often are, for their bones, may be boiled down, and mixed with the flour which all such countries produce, and so converted into a substance of such durability, that it may be preserved with the greatest ease, and sent to distant countries, it seems as if a new means of subsistence was actually offered to us. Take the Argentine republic—take Australia—and consider what they do with their meat there in times of drought, when they cannot get rid of it whilst it is fresh; they may boil it down, and mix the essence with flour (and we know they have the finest in the world), and so prepare a substance that can be preserved for times when food is not so plentiful, or sent to countries where it is always more difficult to procure food. Is not this a very great gain?

A LOST ART.

(From Babbage's "Economy of Manufactures.")

PRINTING FROM COPPER PLATES WITH ALTERED DIMENSIONS.

Some very singular specimens of an art of copying, not yet made public, were brought from Paris a few years since. A watchmaker in that city, of the name of Gonord, had contrived a method by which he could take from the same copper-plate impressions of different sizes, either larger or smaller than the original design. Having procured four impressions of a parrot, surrounded by a circle, executed in this manner, I showed them to the late Mr. Lawry, an engraver, equally distinguished for his skill, and for the many mechanical contrivances with which he enriched his art. The relative dimensions of the several impressions were 5·5, 6·3, 8·4, 15·0, so that the largest was nearly three times the linear size of the smallest; Mr. Lawry assured me that he was unable to detect any lines in one which had not corresponding lines in the others. There appeared to be a difference in the quantity of ink, but none in the traces of the engraving; and from the general appearance, it was conjectured that the largest but one was the original impression from the copper plate.

The means by which this singular operation was executed have not been published; but two conjectures have been formed at the time which merit notice. It was supposed that the artist was in possession of some method of transferring the ink from the lines of a copper plate to the surface of some fluid, and of re-transferring the impression from the fluid to paper. If this could be accomplished, the print would, in the first instance, be of exactly the same size as the copper from which it was derived; but if the fluid were

contained in a vessel having the form of an inverted cone, with a small aperture at the bottom, the liquid might be lowered or raised in the vessel by gradual abstraction or addition through the apex of the cone; in this case, the surface to which the printing ink adhered would diminish or enlarge, and in this altered state the impression might be re-transferred to paper. It must be admitted that this conjectural explanation is liable to very considerable difficulties, for although the converse operation of taking an impression from a liquid surface has a parallel in the art of marbling paper, the possibility of transferring the ink from the copper to the fluid requires to be proved.

Another and more plausible explanation is founded on the elastic nature of the compound of glue and treacle, a substance already in use in transferring engravings to earthenware. It is conjectured that an impression from a copperplate is taken upon a large sheet of this composition ; that this sheet is then stretched in both directions, and that the ink thus expanded is transferred to paper. If the copy is required to be smaller than the original, the elastic substance must first be stretched, and then receive the impression from the copper-plate: on removing the tension, it will contract, and thus reduce the size of the design. It is possible that one transfer may not in all cases suffice, as the extensibility of the composition of glue and treacle, although considerable, is still limited. Perhaps sheets of India-rubber, of uniform texture and thickness, may be found to answer better than this composition ; or possibly the ink might be transferred from the copper-plate to the surface of a bottle of this gum, which bottle might, after being expanded by forcing air into it, give up the enlarged impression to paper. As it would require considerable time to produce impressions in this manner, and there might arise some difficulty in making them all of precisely the same size, the process might be rendered more certain and expeditious by performing that part of the operation which depends on the enlargement or diminution of that design only once ; and instead of printing from the soft substance, transferring the design from it to stone; thus a considerable portion of the work would be reduced to an art already well known, that of lithography. The idea receives some confirmation from the fact that, in another set of specimens, consisting of a map of St. Petersburgh, of several sizes, a very short line, evidently an accidental defect, occurs in all the impressions of one particular size, but not in any of a different size.

REVIEWS.

The Naval Dry Docks of the United States. By Charles B. Stuart, Engineer in Chief of the U. S. Navy. New York: C. B. Norton. London : John Weale.

American mechanical works have not been received with much favour in this country hitherto, owing to the prevalent practice of drawing largely on English works of a similar character, and in most cases without any acknowledgment of the source whence the information is derived. That an ample fund of original information exists in the United States there can be no doubt, but it is rarely the information is presented in such a practical form as to render it valuable. Not that we lay any stress on expensive engravings or letter press, but we protest against the substitution of mere pictorial representations for *bonâ fide* working plans. We rejoice to notice a few exceptions, amongst which we may mention Bartol's *Marine Boilers*, Colburn's *Locomotive Engines*, and the work before us. Mr. Stuart's work gives us the history and details of construction, and cost of the various dry docks built for the United States' government, and which are not surpassed in size or importance by any others in the world. The work is most expensively got up, all the plates being on steel and very highly shaded, whilst the typography and paper is superior to anything ordinarily issued from the American press. Mr. Stuart's official position has given him access to all the information which the navy records are capable of affording, and they seem to have been selected with judgment and care. That portion of the work which presents the greatest novelty to English engineers is the description of the floating dry docks, a method of which we have no examples on this side of the Atlantic. The following condensed description (from the *Franklin Journal*) will be found interesting :—

"The United States Dry Dock at this port having recently been completed, was successfully tested during the past month by the lifting and hauling out of the steam-ship *City of Pittsburg*, of 2,530 tons burthen. This dock and appendages being the largest in the world, merits more than a passing notice. The lifting power consists of nine sections, six of which are 105 feet long inside, and 148 feet over all, by 32 feet wide, and $11\frac{1}{2}$ feet deep; three of them are of the same length and depth as the others, but 2 feet less in width; the gross displacement of the nine sections is 10·037 tons, gross weight 4,145 tons, leaving a lifting power of 5,892 tons, which far exceeds the weight of any vessel yet contemplated. The machinery for pumping out the sections consists of two engines of 20, and two of 12 horse power. In connection with the sections (which form the lifting power of the dock) is a large stone basin, 350 feet long, 226 feet wide, and 12 feet 9 inches deep, with a depth of water of 10 feet 9 inches at mean high tide.

"At the head of this basin are two sets of ways, each being 350 feet long and 26 feet wide. These ways are level, and consist of the bed pieces, which are three in number, and firmly secured to a stone foundation ; the central way supports the keel, while the side ways receive the weight of the bilge; these ways are of oak, and are finished off to a smooth surface. On the top of the bed-pieces or fixed ways comes the sliding ways or cradle, which are also 350 feet long and 26 feet wide, so constructed as to admit of being adjusted to the length of any vessel.

"The operation of the dock is as follows :—The sections are sunk so as to allow the vessel to be floated in ; as soon as she is secured in the proper position, the pumps are put in operation, when the sections begin to rise ; and as soon as they come to a bearing on the keel, the bilge blocks are run in until they fit the ship. When all is secure, the sections are pumped out until the keel is some two or three feet above the water. If repairs that will only require a short time are contemplated, the vessel is kept on the sections, and no other portions of the dock used. But the *Pittsburg* was taken up for the purpose of testing the several parts of the dock, and after she was lifted out of the water the sections carrying the ship were floated into the basin in line with one of the sets of ways. When this is accomplished, the sections are filled with water, and rest on the bottom of the basin, which is of stone. Bed ways are now laid on the sections, in line with hose before mentioned. When they are secured, they are greased, and the cradle is now slid under the ship, and she is blocked up on the cradle, and the blocks on the sections are removed. At this point of the operation a new instrument of power is brought forward, for the purpose of hauling the ship from the sections on to the bed ways in the navy-yard. It consists of a large hydraulic cylinder, having a ram of 15 inches diameter and 8 feet stroke, and a power of 800 tons. On the top of this cylinder, and attached to it, are two vertical direct-acting engines, with cylinders 16 inches in diameter and 16 inches stroke, connected at right angles to one shaft, on which are four eccentrics for working four hydraulic pumps of $1\frac{1}{2}$ inches bore, and 6 inches stroke; the tank which carries the water for the press is also on the top of the cylinder, and forms the bed on which the pumps are secured. The boiler which supplies these engines with steam is on a sliding cast-iron bed way, some 12 or 15 feet ahead of the hydraulic cylinder, and connected to it by two cast-iron rods. This boiler is of the usual locomotive form, and has 85 tubes of 2 inches diameter, and 9 feet long. To get ready for operation, the hydraulic cylinder is slid down to the edge of the basin, its ram is run in, and a connection made by means of two side-rods of wrought-iron from the cross-head of the ram to the sliding-cradle which carries the ship. The central bed way has key-holes mortised through it horizontally every 8 feet, and there are projections from the hydraulic

cylinder, which have corresponding key-holes in them. Two cast-iron keys, 24 inches wide and 6 inches thick, are slid through the key-holes on small wheels; these keys secure the cylinder to the central bed way. The engines and pumps being now put in operation, a pressure is brought on the 15-inch ram, and as soon as the pressure overcomes the resistance, the vessel must move. The estimated weight of the *Pittsburg* was 2,800 tons, exclusive of the sliding ways and blocking; the power required to start this weight on a level, greased surface was 250 tons. As soon as the vessel has been moved eight feet, the keys which hold the cylinder to the central way are withdrawn, and by means of a screw which is attached to the head block of the ram, and driven from the engine, the cylinder and boiler are in their turn rapidly slid ahead (the water in the cylinder being allowed to escape into the tank), when the cast-iron keys are again slid in place, and the vessel moved another eight feet. After the first starting of the *Pittsburg*, the power required to remove her was but 150 tons, and she was moved 260 feet in 6 hours. To push the vessel off, the cylinder and appendages are moved to the head of the ways, put on a turn-table, and reversed, when it is again brought down to the cradle, and the cylinder being secured, as before, the head of the ram is applied directly to the cradle, and the vessel shoved back on to the sections, which requires the same time and power as to haul them off. In docking and hauling out the *Pittsburg*, every part of the work gave the most entire satisfaction, no portion showing the least defect, and the time required to go through the various operations being less than was expected. But six sections were used for lifting in this operation, leaving three unemployed. It will at once be seen that the capacity of this dock exceeds that of the stone docks at New York, Boston, and Norfolk combined; for, united, they can take but three vessels, while here, two of our longest war-steamers may be hauled out on the ways, and two frigates lifted on the sections. The advantages that must result from the facilities of repairing a vessel elevated into light and air above one sunk in a stone dock, are very great, and have only to be seen to be appreciated."

On a future occasion we will discuss some other points suggested by this important work, which reflects the greatest credit on the American engineering profession generally, and will serve as a standard, which we hope to see future works attain, but which they can hardly surpass.

The Practical Examinator of Steam and the Steam Engine. By W. Templeton, Engineer. London: Atchley and Co.

This work is an enlarged and improved edition of *Incitements to the Study of Steam and the Steam Engine*, by the same author, which will be found reviewed in our vol. for 1848, p. 175. Without being a perfect catechism of the steam engine, it contains, in a compendious form, a variety of useful information on those points which the practical man ought to be master of. Amongst these may be mentioned:—Calculations of the effect of refrigerators—Working expansively—Adjustment of the slide valve, parallel motion, &c.—Contents of pumps—Logarithms—Tables of areas (progressing both by eighths and tenths in one column)—Diameters of cylinders for given powers—Foreign weights, measures, money, &c. One of Mr. Templeton's tables we must protest against, viz.—*Table of Nominal Velocities for the Pistons of Steam Engines*, which, if given at all, for which we know no reason, should have been accompanied by some counteracting remarks, to show its absurdity.

Reports by the Juries of the Great Exhibition.

The issue of this work, which has been anxiously looked for by the exhibitors as well as by the public, has been delayed so long, that we apprehend there is considerable danger of its sharing the fate of the Illustrated Catalogue, to which it should form a supplement. In spite of many and great defects, inseparable, probably, from any book produced by a number of individuals working each in his own fashion, these reports embrace a vast amount of valuable information, from which it is difficult, however, to abstract with much satisfaction. We have attempted to do so at another page, and as soon as the voluminous nature of the task will admit, we will proceed to criticise some of the salient points of. We ought not to omit to caution our Continental readers against accepting the verdicts of the juries as exactly representing the opinions of the practical men of this country. As an example, we may mention a "notice" of the high-pressure steam engine of M. Flaud, which concludes as follows:—"The high pressure (75 lbs. per square inch) at which it is proposed to work this engine is, however, to be deprecated, as attended with great risk, and with great loss, by reason of the high temperature."

French engineers, in their simplicity, perhaps think that the pressure is a question depending rather on the boiler than the engine, and that high pressures are attended with an economy which more than counterbalances any loss by radiation.

The Illustrated London Drawing Book. By Robert Scott Burn. 8vo. pp. 146.

The Illustrated London Geography. By Joseph Guy, jun. 8vo. pp. 132. Office of the Illustrated Library: London.

These are two volumes of the series entitled the *Illustrated London Library*, although why the distinctive appellation "London" should be kept up we are at a loss to imagine. Mr. Burn is already favourably known to the readers of *The Artizan*, and it is sufficient for us to say that his treatise is distinguished by the same practical tone which characterises the other productions of his pen. The pupil is led by an easy gradation from the simple outline to the perfect figure. Ordinary and isometrical perspective are carefully explained, and an outline given of the arts of copperplate and wood-engraving. This work will form an excellent handbook for the class teacher.

Mr. Guy's *Geography* is adapted for children of a much younger age, and will, we doubt not, be found useful. The author makes some very judicious remarks, in the preface, on the impolicy of placing maps of inadequate size and construction before children, and we hope that his readers will take the hint more readily than his publishers appear to have done.

The Builders' Pocket Book of Reference. By Henry Malpas, Surveyor. London: Rouse and Co.

This is a useful little work by a practical man. The leading contents are:—Tables of the strengths of wood and iron beams, straps and bolts, and other building materials; the adhesive power of nails, &c., accompanied by some judicious remarks on roofing, and flooring, and the value of leasehold and freehold property. As a matter of justice to the author, we think we ought to give him a hint that the high price attached to his work will materially diminish its sale.

The Engineers' and Contractors' Pocket Book for 1852-3. London: John Weale.

This is just one of those kinds of books of which no adequate idea can be given without specifying all its contents. We need only say that it contains a large mass of useful information, which may be found floating in a library of mechanical works, but which is here presented in an accessible form.

The Colonial and Asiatic Review for July. London: John Mortimer.

This journal is the result of an amalgamation of the *Colonial Magazine* and the *Asiatic Journal*, and, judging from a first number, appears not to lack well-directed energy. If any interest in the empire need a repre-

sentative, it is our colonies. Debarred from representatives in the legislature, their complaints and wants excite no attention, until rebellion extorts that redress which is denied to mere remonstrance.

Many events seem to point to the present moment as the commencement of a new era in our intercourse with our colonies; and the *Colonial and Asiatic Review*, if duly supported by those whom it is intended to serve, may perform no unimportant part in the diffusion of sound information, and the removal of that dense ignorance which prevails in this country on all colonial matters.

CORRESPONDENCE.

To the Editor of the Artizan.

Sir,—The recent sacrifice of life which attended the loss of the *Amazon* and *Birkenhead* has called forth, among other inventions, that of a self-acting plug for the boats.

The valve of Lieutenant Stevens* has been put in practice, but it is disapproved of by some, in consequence of the centre bolt getting screwed too tight, or, from the swelling of the leather disc, the upper table of the valve cannot be turned round; after trial, they were rejected by the West India Mail Company for this defect.

Another valve (or plug) has been invented by Mr. Lisabe, which consists of a brass box perforated, containing a ball, which, when the boat is immersed, is pressed against an India-rubber seating, and the water is thus kept out of the boat; and when the boat is suspended in the davits, the ball falls by its own gravity, and allows the water to escape.

As this design is very similar to one which I formed some months ago, in connection with a scheme for lowering ships' boats, I am tempted to commit it to print, because I think it is less complicated in its con-

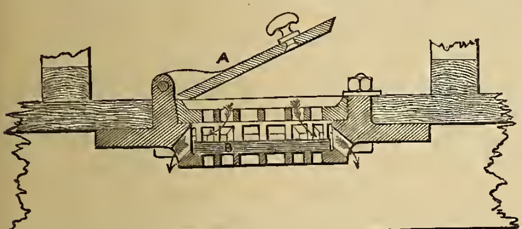


Fig. 1.

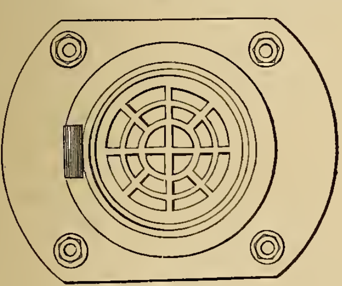


Fig. 2.

struction than that of Mr. Lisabe's. Fig 1 is a sectional elevation, and fig. 2 a plan, with the upper lid, A, removed. The lower casting forms a shield and face to the India-rubber disc, B, and flanch for bolting to the bottom planks of the boat; the upper face is screwed into the lower one, as shown, whilst the lid, A, fits into the top of the upper face or shield.

When the boat is suspended in the davits, the disc, B, will fall on to the lower face, and allow the water to escape through the sides, in the direction of the curved arrows; and when the boat is in the water, the disc will be floated and pressed against the upper face, and the water will thus be effectually kept out; the lid, A, is provided for the purpose of keeping in the water, when it is necessary to clean the boats. India rubber has now been used for several years for marine-engine air-pump buckets, in an exactly similar manner, with the most perfect success; and there can be no reason why it should not act in the present case.

Yours obediently,

"Navalis."

* See *Artizan*, 1850, p. 259.

PARKER AND FIELD'S IMPROVED REVOLVER PISTOL.

The great demand for these very useful weapons, revolvers—"six-shooters"—has led many of our makers to further improvements. Amongst these, is a neat modification of the ramrod, which has been registered by Messrs. Parker and Field, the eminent gun makers, of London, which is represented in the accompanying engraving. Fig. 1 is a side elevation of the pistol, one-third the full size; and fig. 2 is a sketch of the ramrod, detached. The ramrod is contained in a small cylindrical case, fastened by screws to the side of the barrel, and is connected to a spiral spring in the case, so that, after ramming down the charge, the ramrod returns to its position in the case as soon as it is released. The outer end is furnished with a T handle, which admits of being turned out of the way, when not required for loading, as shown in fig. 1.

To prevent the issue of smoke from the joint between the barrel and the revolving chamber, the mouths in the latter are coned out, and the end of the barrel is coned to fit them. Whilst the pistol is at half-cock, the chamber is drawn back to allow it to revolve clear of the barrel, but when the hammer is descending on the nipple, the chamber is, by the action of the lock, moved forward, so as to bring the two cones together, and make a tight joint. This arrangement obviates the difficulty felt with many of the revolvers, which, when worn a little

Fig. 1.

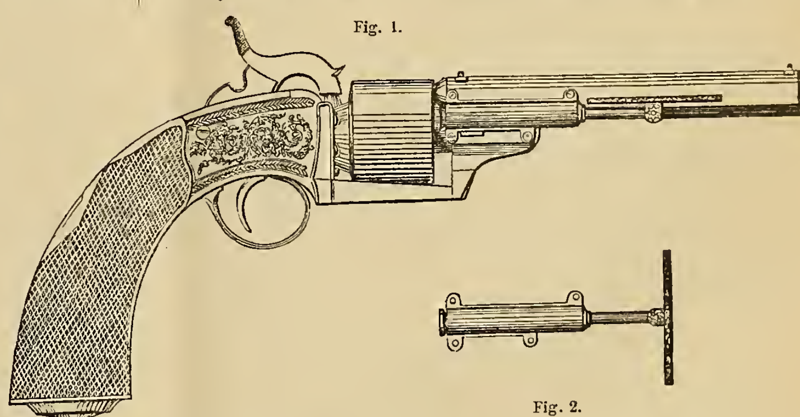


Fig. 2.

slack, do not always bring the barrel and chamber in an exact line. The hammer is raised as in an ordinary pistol, and is set on one side, so as to allow of an accurate aim being taken along the barrel.

REMARKS ON H. B. M. SCREW STEAM FRIGATE *ARROGANT*.

By Chief Engineer, B. F. Isherwood, U. S. Navy.

The *Arrogant* has long been considered the most successful application of an auxiliary screw to a war steamship. Having been furnished directly from her chief engineer with a number of her indicator cards, and accompanying data of speed, revolutions of screw, &c., I thought it might be of interest to steam engineers and ship constructors, to publish these results, giving additionally the full dimensions of *hull*, *engines*, *boilers*, and *screw*, obtained from the chief engineer of the vessel and other sources, in order that a correct opinion might be formed. As these results may be relied on, they will go far to correct some very exaggerated reports of the performance

of this vessel, as well as to show the latest manner of using steam in the British navy.

Hull.

Length between perpendiculars	200 feet.
Length of keel for tonnage	172 „ $9\frac{5}{8}$ inches.
Breadth, extreme	45 „ $8\frac{1}{2}$ „
Breadth, moulded	44 „ 4 „
Depth of lower hold	15 „ 1 „
Mean draft, half coal in, and all other weights full..	19 „ 0 „
Burthen..	1872 tons.
Displacement at 19 feet draft..	2470 „
Immersed amidship section at 19 feet draft	587 square feet.

Engines.—Two of Penn's horizontal trunk, condensing engines, placed on board at Woolwich in 1848. The exhaust pipe, which is the highest part of the engines, is 4 feet 8 inches below the water line; the tops of the cylinders are 6 feet 11 inches below water line.

Diameter of cylinder, 60 inches } equivalent to a diameter of „ trunks, 24 „ }	55 inches.
Stroke of piston	3 feet.
Space displacement of both pistons per stroke ..	98·99 cubic feet.
Diameter of main steam pipe	18 inches.
Leading into steam pipe of diameter of	14 „
Diameter of eduction pipes	18 „
Diameter of overflow pipes	18 „
Extreme length of engine and boiler rooms, bulkhead to bulkhead	56 feet.

Slide Valves.

Lead on top lid, or lid to cylinder cover	$\frac{3}{16}$ inch.
Lead on bottom lid	$\frac{5}{16}$ „
Carries steam on top stroke	28 inches.
„ bottom stroke	26 „
Lead of exhaust on top lid of valve	$7\frac{1}{2}$ „
„ bottom lid of valve	$7\frac{1}{2}$ „
Length of slide faces	9 „
Length of ports..	$5\frac{7}{16}$ „
Exhaust ports at bottom	$3\frac{5}{8}$ „
„ top	$3\frac{1}{8}$ „

Note.—When steam is admitted into the top end of the cylinder, the exhaust port is open $3\frac{15}{16}$ inches; and when admitted into the bottom end, the exhaust port is open $3\frac{3}{4}$ inches. The lead at the crank end of the cylinder is $\frac{5}{16}$ inch, and at the cylinder cover end $\frac{3}{16}$ inch.

Shafting.

Diameter of shaft at main bearing	$10\frac{1}{2}$ inches.
„ connecting shaft bearing	$9\frac{1}{2}$ „
„ screw propeller shaft at large end ..	14 „
„ „ „ small end ..	9 „
Length of shafting from inside of stern post to forward part of coupling on crank shaft	69 feet 1 inch.

Boilers.—Four horizontal tubular boilers, placed in such a manner that the top of the steam chest is 3 feet 4 inches below the water line.

Number of tubes in each boiler	264
Outside diameter of tubes	$2\frac{1}{2}$ inches.
Length of tubes	5 feet 6 inches.
Length of each boiler	12 „ 3 „
Breadth..	10 „ 7 „
Height	7 „ 4 „
Number of furnaces in each boiler	3
Length of each furnace, that is, of grate bars in each furnace	5 feet.
Breadth..	3 „
Area of total grate surface	180 square feet.
„ heating „ in tubes .. 3800·544 sq. ft.	
„ „ „ furnaces, &c. 634·000 „	
Area of total heating surface in the 4 boilers	4434·544 sq. feet.

Extreme height of chimney when up above grates ..	44 feet.
Length of upper or sliding part of chimney	15 feet 8 inches.
Diameter of lower or fixed part of chimney	5 „ $3\frac{3}{4}$ „
„ upper or sliding part „	5 „ $1\frac{1}{4}$ „
Weight of water in boilers	39 tons.
Consumption of English bituminous coal per 24 hours, working with full power at sea with steam alone, in good weather, boiler pressure 5 pounds per square inch, cut off at $\frac{3}{4}$ths the stroke from the commencement, making $44\frac{2}{3}$ double strokes of piston per minute, initial cylinder pressure 18 pounds per square inch	32 tons.
Sea water evaporated under the above circumstances by one pound of coal, inclusive of loss by blowing off at 3-32, and by waste of steam in clearance and nozzles	6·836 pounds.
Coal consumed per hour per square foot of grate surface	16·600 „

Weight of coal carried in bunkers, 260 tons, or sufficient for 8 days' steaming at full power.

Screw.—One true screw, placed at the stern in a sliding frame, so as to be raised out of the water when the ship is under sail alone.

Diameter	15 feet 6 inches.
Pitch	15 „ 0 „
Length on axis..	2 „ 6 „
Number of blades	2
Helicoidal area of screw	136 square feet.
Area of screw projected on a plane at right angles to axis	61·85 „

Results.

Speed of vessel at sea under steam alone, in good weather, working at the reduced power used in calms and smooth water, viz.: cutting off at about $\frac{1}{8}$th from commencement of stroke, and having a mean effective pressure per square inch of pistons throughout the stroke of $7\frac{2}{3}$ pounds, making $33\frac{2}{3}$ double strokes of piston per minute ..	3·833 knots of $6082\frac{2}{3}$ feet.
Horse power developed by engines under the above circumstances	223·99
Speed of vessel at sea under steam alone, in good weather, working with full power, viz.: an initial pressure in cylinder of 18 pounds per square inch, cutting off at $\frac{3}{4}$ths the stroke from the commencement, giving a mean effective pressure throughout the stroke of $13\frac{1}{2}$ pounds per square inch of pistons, making $44\frac{2}{3}$ double strokes of piston per minute	5·08 knots of $6082\frac{2}{3}$ feet.
Horse power developed by engines under the above circumstances	520·96
Slip of the screw under the above circumstances ..	23·04 per cent.

Indicator Diagrams from Steam Cylinders. Scale, 10 pounds to the inch.

No. 1.—Taken August 4th, 1851. Sea smooth, and variable head airs; speed by patent log, 3·70 knots per hour; revolutions of the screw, 33 per minute; mean effective pressure per square inch of piston, 8·14 pounds. *Slip of the screw*, 24·22 *per cent.*

No. 2.—Taken August 5th, 1851. Moderate head swell, and airs ahead; speed by patent log, 4 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·48 pounds. *Slip of the screw*, 20·49 *per cent.*

No. 3.—Taken August 4th, 1851. Sea smooth; fore and aft sails set; speed by patent log, 5·8 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·69 pounds. *Negative slip of the screw*, 15·29 *per cent.*

No. 4.—Taken August 5th, 1851. Sea smooth; calms and head airs; speed by patent log, 3·80 knots per hour; revolutions of the screw, 34 per

minute; mean effective pressure per square inch of piston, 7·35 pounds. *Slip of the screw*, 24·46 *per cent.*

No. 5.—Taken May 4th, 1850. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 40 per minute; mean effective pressure per square inch of piston, 8·08 pounds. *Slip of the screw*, 29·04 *per cent.*

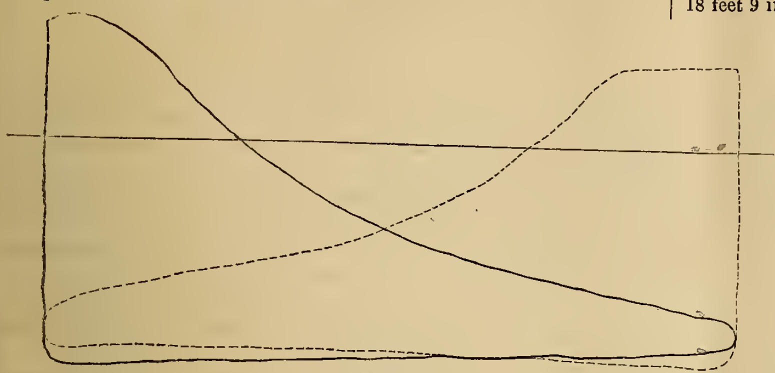


Fig. 1.

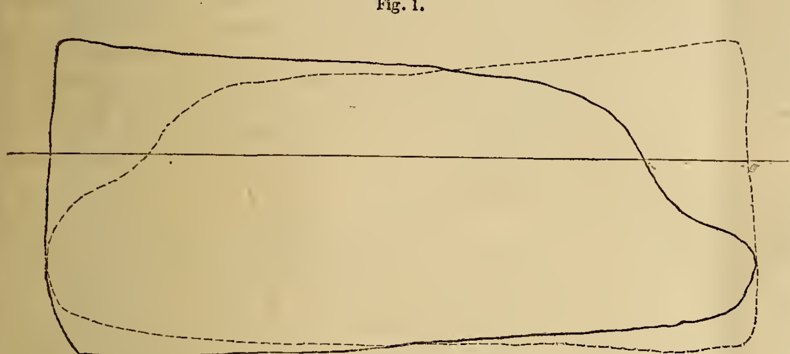


Fig. 7.

No. 6.—Taken August 5th, 1851. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 51 per minute; mean effective pressure per square inch of piston, 12·99 pounds. *Slip of the screw*, 44·34 *per cent.*

No. 7.—Taken August 2nd, 1851, leaving Gibraltar for Lisbon. Sea smooth, strong free wind, and all sails set; speed by patent log, 10·60 knots per hour; revolutions of the screw, 64 per minute; mean effective pressure per square inch of piston, 13·88 pounds. *Negative slip of the screw*, 11·94 *per cent.*

All the above diagrams, excepting No. 5, were taken on a passage from Gibraltar to Lisbon, with a mean draft of about 19 feet, and show the performance of the vessel under the most favourable circumstances, having a smooth sea and short run.

Under these favourable circumstances, the mean performance at sea, under steam alone, was for full power; that is, a mean effective pressure of $13\frac{1}{2}$ pounds per square inch of piston, and $44\frac{2}{3}$ double strokes of piston per minute, 5·08 knots; and for the reduced power used in calms and fine weather, viz., a mean effective pressure of $7\frac{2}{3}$ pounds per square inch of piston, obtained by cutting off at about $\frac{1}{8}$th the stroke from the commencement, and $33\frac{2}{3}$ double strokes of piston per minute, a speed of 3·833 knots per hour. These are slow speeds, and would not by any means be considered satisfactory in our navy. Every war steamship with us having a less average sea speed than 9 knots per hour is pronounced a failure, without regard to the comparative power of the machinery, consumption of fuel, and size of vessel. It is thus that nearly all our navy steamships are failures; but fairly compared relatively, power with power, fuel with fuel, and size of vessel with size of vessel, I believe our navy war steamships will be found to give higher results, both in the generation of steam, its mode of use in the engine, and application to the propelling instrument, than can be found elsewhere, at home or abroad.

These diagrams also show in a very striking manner the effect of using sail in conjunction with the screw, and the existence of what is termed *negative* slip. A few remarks on this subject may be of use in this connection, sufficient data being luckily furnished by a trial of the *Arrogant* in the Thames river.

January 8th, 1849, the *Arrogant*, drawing 16 feet 10 inches forward, and 18 feet 9 inches aft, was tried at the measured mile in the Thames river, and made at the rate of 7·25 knots per hour; revolutions of the screw, 63 per minute; mean effective pressure per square inch of pistons by indicator, 13·31 pounds; horse power developed by the engines, 672·7. *Slip of the screw*, 22·23 *per cent.*

August 2nd, 1851, the *Arrogant*, leaving Gibraltar for Lisbon, made, in smooth water, strong free wind, and all sail set, 10·60 knots per hour by patent log; revolutions of the screw, 64 per minute; mean effective pressure per square inch of pistons by indicator, 13·88 pounds; horse power developed by the engines, 767·45. The screw had now what may be termed a *negative* slip of 11·94 per cent.; that is, the speed of the vessel was 11·94 per cent. *greater* than the speed of the screw.

It may now be supposed that the screw, instead of assisting the progress of the vessel, was retarding it by dragging. That this was not the case, however, and that the screw under the above conditions was still actually propelling the vessel, will become evident from a consideration of the performance of the vessel in the Thames river, as given in the paragraph above.

During that performance, with 63 revolutions of the screw per minute (slightly less than 64), and a mean effective pressure of 13·31 pounds per square inch of pistons (slightly less than 13·38 pounds), there was developed by the engines sufficient power (672·7 horses), after overcoming the screw resistances of the front edges of the blades, and surface friction on the water, and engine resistances of friction and load on air pump, and also friction of load on the engines, to drive the vessel 7·25 knots per hour.

During the performance on the 2nd of August, when the screw made 64 revolutions per minute, the above-named screw and engine resistances may be considered practically the same as with 63 revolutions. The power now developed by the engines was 767·45 horses. But if the speed of the screw were now really less than the speed of the vessel, and retarding it by dragging, the screw would be assisted in its revolutions by the reaction of the water caused by that greater speed of the vessel; consequently, there would not be required to be exerted by the engines, in order to overcome the screw and engine resistances, as much power as was required when making the 63 revolutions in the Thames river; yet the total power now developed by the engines was greater than before, viz., 767·45, instead of 672·7, while a less power than before was required to overcome the screw and engine resistances. What then has become of the large remainder of this power? It must have been expended on some resistance, and the only resistances opposed to the power of a steam engine, in propelling a vessel by a screw, are the screw and engine resistances, the friction of the load, and the resistance of the vessel itself. We have seen, however, that but a small portion of the power developed by the engines was absorbed in overcoming the screw, engine, and friction resistances; the remainder, therefore, must have been expended in overcoming the resistance of the vessel—that is, in propelling the vessel—notwithstanding that the vessel was *apparently* going faster than the screw, and could not therefore be propelled by it. A little attention to what takes place in the passage of a body through water will reconcile the contradiction.

It is familiar to all, that when a body passes through water, it leaves a vacuity behind, which is filled by the in-rushing water. It is impossible, in any case, that this vacuity can be made and filled simultaneously; *time* is required for the operation, and the effect of time is to generate a current, or give velocity to the in-rushing water; for as the water falls into the vacuity by its gravity, the speed of its current or its velocity will be proportional to

the time required for the water thus to fall in. No matter how fine the after lines of a vessel may be, or how slow its speed, it must have, when in motion, *some* following current, and this current will be in some proportion to the fineness of the after lines and the speed of the vessel. The finer the lines and the less the speed, the less will be the velocity of the following current, because less time will elapse before the following water will have fallen in; or in other words, the following water will have a less distance to flow before it fills the vacuity.

An illustration of the same thing may be had by observing the eddy at the back end of a bridge pier placed in a current of water. A chip thrown into the current at the front end of the pier, close beside it, will not be carried straight on, but will close in behind the pier, and remain at rest.

With a hull of the *Arrogant's* proportions, moving through the water at the high velocity of 10·60 knots per hour, it is very probable the following current had a considerable velocity; and as the screw acted in and against this following current, it might have had a very *positive* slip, comparing the speed of the screw with the vessel's speed diminished by the speed of this current; while it had a *negative* slip, compared with the vessel's absolute speed through the water, supposing no following current to exist, and that the vessel and screw moved through the water in the same condition.

If the water were passing the screw at the vessel's speed it would pass at the rate of 10·60 knots per hour; but if there were a following current of say 1·60 knots per hour, the water would only pass the screw at the rate of 9 knots per hour. The speed of the screw should therefore be cómpared with the latter rate, which, if it could be ascertained, would give the *true* slip of the screw, a slip that would always be found a *positive* one.

It must here be distinctly remembered, that a negative slip can only happen when the vessel has a high speed, and owes a considerable portion of it to a power additional to that applied to the screw, that of the sails, for instance; though it has frequently been reported to exist, when the vessel was being propelled by the screw alone. In these cases, it was manifestly the result either of inaccurate observations of distance gone, and revolutions made, or of a mistake in the pitch of the screw, reckoning it less than it actually was.

Supposing the motion of the vessel through the water to leave no vacuity behind it, the resistance of the vessel would occasion a certain positive slip of the screw. Now, suppose this vacuity to exist, the bow resistance of the vessel would be increased by it, and by consequence the slip of the screw would be increased. Now, suppose also, that by reason of this vacuity, a following current be generated, which, striking the screw, diminishes again the increased slip, it is evident that this following current cannot impart *more* power than was absorbed in generating it; that is to say, that its additional resistance to the screw can only equal the additional resistance at the bow thrown upon the screw by the generation of this current. Under the most favourable circumstances, then, the slip would remain the same, either with or without the following current; but in practice it cannot at all retain this equality, for the whole of the power bestowed in generating the following current, and resident in it, cannot be re-applied to the screw; in fact, but a small quantity can be so regained. To say, that in a vessel propelled by a screw alone, the vessel's speed could surpass that of the screw, would be to say, that in the case of a man wheeling a wheelbarrow, the speed of the wheelbarrow surpassed that of the man.—*Franklin Journal.*

SHIPBUILDING ON THE CLYDE.

GREENOCK, 1852.

Messrs. John Scott and Sons have upon the stocks, nearly ready to launch, a 13 years', A 1, ship for the foreign trade; flush on deck.

Dimensions.	ft.	ins.
Length of keel and fore-rake	110	0
Breadth of beam	24	0
Depth of hold	15	6
Tonnage	$293\frac{19}{94}$ tons.	

And is a fine model for fast sailing.

They have just laid down the keel of an iron clipper ship for Messrs. Andrew Orr and Co., merchants, Greenock, for the East India trade; to have a poop and top-gallant forecastle.

Dimensions.	ft.	ins.
Length of keel and fore-rake	168	0
Breadth of beam	30	0
Depth of hold	20	0
Tonnage	$718\frac{28}{94}$ tons.	

Frames $5 \times 3 \times \frac{1}{2}$ inches, and 15 inches apart; stem and keel, $9 \times 2\frac{1}{2}$ inches; stern-post, $9 \times 3\frac{1}{2}$ inches; plates from $\frac{13}{16}$ to $\frac{11}{16}$ of an inch in thickness.

Also an iron clipper ship for Messrs. James and William Stewart, merchants, Greenock, for the East India trade; to have a poop and top-gallant forecastle.

Dimensions.	ft.	ins.
Length of keel and fore-rake	168	0
Breadth of beam	30	6
Depth of hold	20	0
Tonnage	$746\frac{7}{94}$ tons.	

Frames, &c. all similar to the former vessel.

Also another iron clipper ship for Messrs. H. More and Co., merchants, Liverpool, for the East India trade; to have a poop and top-gallant forecastle, &c.

Dimensions.	ft.	ins.
Length of keel and fore-rake	187	0
Breadth of beam	34	0
Depth of hold	22	6
Tonnage	$1025\frac{2}{94}$ tons.	

Frames $5 \times 3 \times \frac{9}{16}$ inches, and 15 inches apart; plates, $\frac{7}{8}$ to $\frac{3}{4}$ of an inch; keel and stem, $9 \times 2\frac{1}{2}$ inches; stern-post, $9 \times 3\frac{1}{2}$ inches.

They are also laying down the keel of a paddle-wheel steam vessel for South Australia.

Dimensions.	ft.	ins.
Length of keel and fore-rake	140	0
Breadth of beam	18	0
Depth of hold	8	9
Length of engine-space	34	0
Tonnage.	Tons.	
Hull	$222\frac{62}{94}$	
Engine-space	$58\frac{56}{94}$	
Register	$164\frac{6}{94}$	

A pair of inclined engines, the cylinders facing each other, of 88 horse (nominal) power; diameter of cylinders, 37 inches $\times$ 3 feet 6 inches stroke; paddle-wheels, diameter effective 15 feet; tubular boiler. Frames, $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$ inches, and 2 feet apart; plates, $\frac{7}{16}$ to $\frac{5}{16}$ of an inch thick; stem, $5 \times 1\frac{1}{8}$ inches; keel, $4 \times 1\frac{1}{8}$ inches; stern-post, $4\frac{1}{2} \times 1\frac{3}{4}$ inches. Built with a clipper bow, and break deck 90 feet long and 2 feet high. The machinery, &c., is by Messrs. Scott, Sinclair and Co., Greenock.

On January the 21st, there was launched from this building-yard the sloop *Vulcan* (of Greenock), the property of the builders, for coasting trade, &c.

Dimensions.	ft.	tenths.
Length on deck	63	2
Breadth on do., amidships	14	9
Depth of hold, do.	6	7
Tonnage	$53\frac{14}{100}$ tons.	
Do. (Act for foreign vessels)	$48\frac{69}{100}$ „	

On June the 21st was also launched by this firm (after being lengthened $32\frac{1}{2}$ feet), the iron paddle-wheel steam-vessel *Magnet*, the property of the Waterford Commercial Steam Navigation Company. The engines and boilers were refitted by Messrs. Scott, Sinclair and Co.; she has sailed for London, to ply from that port to Copenhagen and St. Petersburgh, under the command of Mr. Thomas Collyer.

On July the 3rd was launched a very handsome paddle-wheel steam vessel, named the *Duke of Argyll*, with a clipper bow, for the Glasgow and Lochfine Steam Packet Company, of $255\frac{74}{100}$ tons, and 165 horse (nominal) power. One steeple engine, with 4 tubular boilers, and 2 funnels, by Messrs. Scott, Sinclair and Co., to ply as a consort to the *Mary Jane.*

Messrs. Robert Steele and Co. launched from their building yard, on the 21st of June, the steam vessel *Arabia* (late the *Persia*). At the time appointed, $\frac{1}{2}$ past 2, P.M., as the vessel began to move, she was named the *Arabia* by Miss Louisa Myles, daughter of the Rev. Mr. Myles, of Glasgow. Amongst the gentlemen present at the launch were the Messrs. Burns, of Glasgow, Mr. M'Ivor, of Liverpool, &c.

Dimensions.	ft.	tenths.
Length on deck	284	2
Breadth on do., amidships	37	3
Depth of hold, do.	27	6
Tonnage.	Tons.	
Sectional act	$2393\frac{42}{100}$	
Act for foreign vessels	$2250\frac{64}{100}$	

A pair of sway-beam engines, by Mr. Robert Napier, Vulcan and Lancefield foundries, Glasgow, of 910 horse (nominal) power; diameter of cylinders, 103 inches $\times$ 9 feet length of stroke; diameter of paddle wheels, 37 feet; having tubular boilers, and 2 funnels, &c.

The builders have taken a hint from Brother Jonathan, and moulded the *Arabia* sharper forward than any of the Company's vessels that have been previously built, and the after-run is probably one of the finest and most elegant series of curves, from a vertical straight line to a long flat floor and full round bilges, ever seen. The desiderata of a fine entrance and run have been attained, consistently with large available space and tonnage, owing to the great length, which is 7 times the breadth, while there is ample space for a midship line, without injuring the easy curves at either extremity, so requisite to ensure fast sailing. From the great length, and the immense weight of the machinery to be put on board, she required to be more than usually rigid. This extra strength has been attained by two series of diagonal iron bracing, extending from the main-deck beams down to the bilges. The braces are bolted by through bolts to every timber which they cross. The first series of braces are sunk or checked flush into the timber, the second series lying over them. No amount or disposition of timber could possibly give the strength or rigidity which this complete system of iron bracing effects.

The sleeping accommodations are all arranged under the main deck, and extend the whole length of the vessel fore and aft. There are two berths to every state room, placed fore and aft, an advantage and comfort which voyagers alone can fully appreciate. The state rooms are thoroughly ventilated by spacious louvres, fitted with glass, opening into the passages, and they communicate, in their whole length, with the open air above, through a continuous lateral opening under the seats on each side of the saloon on deck. The saloon extends the whole length of the vessel, affording an unbroken promenade from stem to stern. This is a great improvement upon the detached houses on deck, as hitherto adopted, and affords a vastly increased accommodation, without interfering with the ship-shape of the vessel, or the requisite facilities for handling or working her. The *Arabia* is owned by the British and North American Royal Mail Steam Navigation Company, and is to ply between Liverpool and New York.

DESCRIPTION.

A bust female figure head, no galleries, round sterned, and carvel-built vessel, three decks (flush), stationary bowsprit, two masts, brig rigged, port of Glasgow. Commander Mr. Charles Henry Evans Judkins. Arrived at Lancefield Quay, Glasgow, from Greenock, to receive the machinery, &c.

On July the 21st there was launched by this firm a very handsomely modelled screw steam vessel, named the *Lady Le Marchant.*

Dimensions.	ft.	ins.
Length of keel and fore-rake	110	11
Breadth of beam	21	$1\frac{1}{2}$
Tonnage, O.M.	$212\frac{83}{94}$ tons.	

Fitted with oscillating geared engines, by Messrs. Caird and Co., engineers, Cartsdyke Foundry, Greenock. The screw is brass, with three blades, 8 feet in diameter; to have a tubular boiler. Has accommodation for about 46 passengers, and is to ply on the station from St. John to Harbour Grace, Newfoundland. Classed 13 years, A 1; launching draught of water, with screw and shaft in their places, was 5 feet 10 inches forward, and 8 feet 2 inches aft.

DESCRIPTION.

A bust female figure head, no galleries, round sterned, and carvel-built, standing bowsprit, two masts, schooner rigged. Port of St. John, Newfoundland. Commander, Mr. Andrew Welsh.

Also on the stocks, and in frame, a brig for the West India trade, classed 13 years, A 1, flush on deck.

Dimensions.	ft.	ins.
Length of keel and fore-rake	105	0
Breadth of beam	22	0
Depth of hold	13	3
Tonnage	$236\frac{55}{94}$ tons.	

CARTSDYKE (GREENOCK).

Messrs. Scott and Co., iron shipbuilders, have just laid down the keels of two iron paddle-wheel clipper steamers, for the Riga and Lubeck Steam Company.

Dimensions.	ft.	in.
Length of keel and fore-rake	165	0
Breadth of beam..	24	6
Depth of hold	13	6
Tonnage	$483\frac{75}{94}$ tons.	

A pair of oscillating engines, by Messrs. Caird and Co., of 204 horse (nominal) power. Diameter of cylinders, 54 inches × 4 feet 6 inches length of stroke, with tubular boilers and feathering paddle wheels, &c., with a half-poop 50 feet long and 3 feet in height.

DUMBARTON.

Messrs. Archibald M'Millan and Son launched from their yard, on the 17th of November last, the sloop *Elizabeth* (of Greenock), for the coasting trade.

Dimensions.	ft.	tenths.
Length on deck	59	3
Breadth on do., amidships	5	0
Depth of hold, do.	5	9
Tonnage.	Tons.	
Register	$44\frac{88}{100}$	

Owners, Messrs. Douglass and Graham, Brymner.

Also, launched from this yard, on the 26th of last month, the barque *Isabella Kerr* (of Greenock). Owners, Messrs. John Kerr and Co., merchants. Flush on deck; classed 9 years, A 1. For the West India trade.

Dimensions.	ft.	tenths.
Length on deck..	119	3
Breadth on do., amidships	24	2
Depth of hold, do.	18	0
Tonnage	$442\frac{84}{100}$ tons.	

Also, by this firm, on the 21st of February, 1852, a barque, the *Three Sisters*, the property of Messrs. Peter and Thomson Aitkman, merchants, Glasgow, for the San Francisco (California) trade; classed 8 years, A 1; flush on deck, with roundhouse.

Dimensions.	ft.	tenths.
Length on deck	117	1
Breadth on do., amidships	24	2
Depth of hold, do.	18	9
Tonnage	$467\frac{80}{94}$ tons.	

With a full female figure-head.

Also, by this firm, on the 2nd of August, the 13 years A 1 ship, *Catherine Mitchell*, the property of John Mitchell, Esq., merchant, Glasgow. Has a poop and top-gallant forecastle, and 'tween decks 8 feet in height, with a full female figure-head; no galleries. Will sail on the first voyage from Liverpool to Port Phillip, through the agency of Messrs. Miller and Thomson.

Dimensions.	ft.	tenths.
Length on deck	150	0
Breadth of do., amidships	29	4
Depth of hold do.	21	5
Tonnage	$851\frac{4}{100}$ tons.	

And is the largest vessel built by this firm.

Also on the stocks, and nearly planked, a 9 years, A 1, ship, flush on deck, for the West India trade.

Dimensions.	ft.	in.
Length of keel and fore-rake	120	0
Breadth of beam	26	9
Depth of hold	18	3
Tonnage	$396\frac{81}{94}$ tons.	

Also, just laid down, the keel of a 13 years, A 1, ship, flush on deck, for the East India or Australian trades.

Dimensions.	ft.	in.
Length of keel and fore-rake	165	0
Breadth of beam	32	6
Depth of hold	21	6
Tonnage	$823\frac{6}{94}$ tons.	

CASTLE-GREEN.

Messrs. Denny and Rankine, ship-builders, have just completed five iron luggage-boats, for the Danube Steam Navigation Company. After being fitted up, they are painted red, blue, green, brown, and white, respectively; then marked in a proper manner, taken to pieces, and shipped to Hamburg.

Dimensions.	ft.	in.
Length of keel and fore-rake ..	180	0
Breadth of beam	25	0
Depth of hold	9	0
Tonnage	$552\frac{87}{94}$ tons.	

PENINSULAR AND ORIENTAL COMPANY'S STEAMERS, "MADRAS" AND "BENTINCK."

"MADRAS."

Built by Messrs. Tod and M'Gregor, of Glasgow. Engines by do., of 280 horse (nominal) power.

Dimensions.	ft.	tenths.
Length on deck	233	0
Breadth of beam	31	5
Depth of hold at do.	21	3
Tons register, N.M.	1184 tons.	

Two overhead beam-engines, geared with wheel and pinion. Lamb and Summers' patent flue boilers. Diameter of cylinders, 5 feet $3\frac{1}{2}$ inches; length of stroke, 5 feet; diameter of screw, 14 feet; pitch of do., 18 feet; blades of do., 3; number of boilers, 2; number of furnaces, 8; breadth of do., 2 feet 11 inches; length of fire-bars, 6 feet; number of flues, 64; length of do., 6 feet 8 inches; load on safety-valve, in pounds, per square inch, 10 lbs.; average pressure on piston, 15·6 lbs.; gross indicated power, 746 horse power; consumption of coals per hour, 20 cwt.; date of trial, March 25th, 1852; average revolutions, 25; speed in knots with tide, 11 726; ditto against tide, 10·651. Mortise wheel has 96 teeth; pitch divided into four sets of cogs, each 9 inches on face; pitch of cogs, 4 inches. The pinion of cast-iron has 42 teeth, so that when engines make 25 revolutions, screw makes 57 revolutions. The screw-shaft is enclosed by a tunnel casing, with semicircular top, measuring 5 feet wide × 7 feet 6 inches clear height × 78 feet long.

"BENTINCK."

Built by Messrs. Wilson, of Liverpool. Engines by Messrs. Fawcett and Preston; of 520 horse (nominal) power.

Dimensions.	ft.	tenths.
Length, extreme	217	0
Breadth of beam	36	0
Depth of hold	30	4
Tons register, N.M.	2,090 tons.	

Side-lever engines; new boilers on Lamb and Summers' patent; diameter of cylinders, 6 feet 6 inches; length of stroke, 8 feet; diameter of paddle-wheel over boards, 31 feet 2 inches, feathering; length of boards, 10 feet 2 inches; depth of do., 4 feet; number of do. 18; number of boilers, 4; length of do., 13 feet 8 inches; breadth of do., 10 feet; height of do., including steam-chests, 14 feet 6 inches; cubic feet in steam-chests, 2,000; number of furnaces, 16; breadth of do.. 2 feet 9 inches; length of fire-bars, 6 feet; number of flues, 128; length of do., 6 feet 3 inches; diameter of chimney, 5 feet 4 inches; height of do., 44 feet from top of boiler; load on safety-valve in pounds, per square inch, 12 lbs.; average pressure on piston, 20·6 lbs. per square inch; gross indicated power, 1,550 horse power; area of immersed section, 596 square feet; contents of bunkers, in tons, 620 tons; consumption of coals per hour, 38 cwt.; date of trial, November 12th, 1851; draft forward, 17 feet 7 inches; do. aft, 18 feet 2 inches; average revolutions, 16; speed in knots, 10·7.

The average speed at sea of *Bentinck*, in the four voyages made to Alexandria since her alterations, has been 10·5 nautical, or 12·09 statute miles per hour. Her consumption of coal has been more *per hour*, but less considerably per *voyage*, than before. The patent boilers of Messrs. Lamb and Summers give her ample steam.

Ericsson's Caloric Engine.—We gave a plate and description of this invention in the *Artizan* for August, 1851. The following details of its application on a large scale may be useful:—"The regenerator in the 60-horse engine measures 26 inches in height and width internally. Each disc of wire composing it contains 676 superficial inches, and the net has 10 meshes to the inch. Each superficial inch, therefore, contains 100 meshes, which, multiplied by 676, give 67,600 meshes in each disc; and as 200 discs are employed, it follows that the regenerator contains 13,520,000 meshes; and, consequently, as there are as many small spaces between the discs as there are meshes, we find that the air within is distributed in about 27,000,000

minute cells. Hence it is evident that nearly every particle of the whole volume of air, in passing through the regenerator, is brought into very close contact with a surface of metal which heats and cools alternately. The wire contained in each disc is 1,140 feet long, and that contained in the regenerator is, consequently, 228,000 feet or $41\frac{1}{2}$ miles in length, the superficial measurement of which is equal to the entire surface of four steam-boilers, each 40 feet long and 4 feet in diameter; and yet the regenerator, presenting this great amount of heating surface, is only about 2 feet cube—less than $\frac{1}{1920}$ of the bulk of these four boilers. This engine, according to the account from which we quote, has been run at full speed for 24 hours, with a consumption of only 960 lbs. of coal. After feeding the fires, it continues to run three hours without replenishment, and after withdrawing them from the grates it operates with full power for an hour, in consequence of the astonishing action of the regenerator alone." A good authority on the spot tells us, be has no doubt the boat will *go*, but he *does* doubt her effective power and speed.

Effect of Size on the Speed of Vessels.—At the present moment the following calculation, from Bourne's *Treatise on the Screw Propeller*, may be found useful :—

"I shall now consider what would be the speed that would be attained by a vessel of the same form as the *Fairy*, and the same proportion of power to tonnage, but of 3 times the length, and consequently of 9 times the area of immersed section, 27 times the capacity, and 9 times the power. The length of such a vessel would be 434 feet, the breadth 63 feet $4\frac{1}{2}$ inches, the draught of water about $16\frac{1}{2}$ feet, the area of the immersed section about 729 square feet, and the power 1,080 horses. Now, as the lengths of the *Fairy* and of the new vessel are in the proportion of 1 to 3, the speeds will be in proportion of the square root of 1 to the square root of 3, or, in other words, the speed of the large vessel will be 1·73 times greater than the speed of the small vessel. If, therefore, the speed of the *Fairy* be 13 knots, the speed of the new vessel will be 22·49 knots, although the proportion of power to sectional area is, in both vessels, precisely the same. If the speed of the *Fairy* herself had to be increased to 22·49 knots, the power would have to be increased in the proportion of the cube of 13 to the cube of 22·49, or 5·2 times, which makes the power necessary to propel the *Fairy* at tbat speed, 624 horse power."

Caution to Water Companies.—An action was recently brought against the Bristol Water-Works Company by a cabinet maker, whose premises and stock were destroyed by fire, owing to the company not having provided fire-plugs, and the mains being empty. The defence was, that if the water were turned on by night there would not be enough by day, and that as the works were not completed, the act of parliament did not apply. The judge overruled this legal point, and the facts heing clearly proved, the jury gave a verdict against the company for £531 18*s.* 7*d.*

NOTES ON AMERICAN INVENTIONS.

Fire-Bars of Fire Clay.—Mr. F. P. Dimpfel, of Philadelphia, has patented in the U. S., fire-bars, composed of fire-clay, soapstone, or other refractory substance, either alone or supported by a metallic casing. The objection to this plan for steam boilers appears to be the difficulty of making them thin enough to give a good draught. Thin bars and narrow spaces give plenty of air and space, prevent the small coal from falling through, and are economical of fuel. Fire-clay bars, however, may prove useful for gas retorts, and furnaces of various descriptions where space is not an object.

Flour-Packing Machines.—We observe that machinery is used in America for packing flour in casks, the object being, we presume, to obtain a dense mass, not easily affected by air or moisture, as well as to economise space. As far as we can learn, it is a conical spiral plate, which forces the flour into the barrel. The barrel may be supported by a varying balance weight or a spring, to allow it to descend as it is filled, or the spiral might rise in the same way. An object being to pack it uniformly, we observe that Mr. N. Finman, of New York, has patented a friction clutch, as applied to such a machine, to equalise the pressure.

Improved Brushes.—Brushes made with fixed handles are inconvenient for many purposes. Mr. F. Murrow has, therefore, patented the fixing of the handle hy a ball and socket joint, so that the handle can be set at any angle suitable for whitewashing, painting, &c. The handle is also made of the telescopic form, to admit of its length being varied as required.

Improved Cart.—To facilitate the unloading of carts, the bottom is composed of "slats," *i.e.*, in the Venetian blind form, so that by their being opened, the load is permitted to fall through. It is obvious that this is only applicable to certain cases, amongst which we may suggest the distribution of dry manure and the materials for mending roads.

Manufacture of Boiler Tubes.—Messrs. T. Prosser and Sons, of New York, have commenced the manufacture of tubes intended to withstand external pressure, in which the junction is effected by simple mechanical pressure, without brazing or welding. The advantages claimed for them are increased strength and diminished probability of corrosion, owing to the preservation of the surfaces of the original boiler plate from which the tubes are made, which, in the ordinary plan, are abraded by passing through dies.

Improved Razor Strop.—This strop is made to revolve by being hung at the ends on centres, and so that it cannot be soiled by touching the case. We would suggest that it be made of a triangular section, so as to give three stropping sides, varying in fineness, and inserted in a rectangular box, divided along the middle, to form the bottom and lid.

New Smoothing Iron.—These irons are heated, not by the insertion of a heater, or by heing placed on a stove, but by being actually converted into portable furnaces heated with charcoal. The interior is made hollow, and provided with regulators for the admission of air to support the combustion of the charcoal.

Hollow Saw Frames of metal have been patented by Mr. W. C. Brouson, of New York. The object is to obtain more rigidity with less weight of moving parts, and thus admit of higher speeds being used. This plan is in use at the shipbuilding yard of Messrs. Wigram, London; the frames for sawing curved timbers, on Hamilton's patent, being construeted by Messrs. Fox, Henderson & Co. For description, see *Artizan*, 1850.

Improved Boot-Jack.—This boot-jack, patented by Mr. S. Thompson, is provided with a "heel gripper," and a "stirrup" for the toe; the latter being pulled down over the toe (as we conclude) by a lever held in the hand during the operation.

Instrument for Opening Boxes.—The object of this instrument is to open packing cases with as little injury to them as possible. As far as we can gather, it consists of two jaws which meet in a wedge shape, and are driven in between the case and the lid. A notch is cut in each, sballower in the upper jaw, which takes the nail when the jaws are forced open, and prevents the nail being drawn through the lid. The opening of the jaws may be effected by a screw, or a wedge driven sideways.

Anti-Bug Mattress.—Mr. T. G. Clinton, of Cincinnati, has patented the use of hide hair, steeped with hides in a tanner's lime vat, with or without other animal or vegetable matter, whereby a new result is attained, (which we must give in the words of the inventor), viz., "An article obnoxious to bed-bugs, without the necessity of any temporary application of poisonous mixtures thereto; thus furnishing the world with a harmless antidote to a great nuisance, and abolishing the necessity for a great peril to human life in the domestic circle!"

GODDARD'S IMPROVED GAS STOVES.

The use of gas in private houses is extending so rapidly, that in many places where the price of gas has been reduced, the companies can hardly keep pace with the demand. Its adaptation to cooking is so perfect, that the only wonder is that it was never introduced before. Had all the com-

panies been as wise as the Ipswich Gas Company, we should have had gas in every house. Their system is to supply and fix the fittings, charging a moderate rent for use and depreciation, a policy which induces hundreds of persons to use gas who would never think of laying out a large sum on an article which was not absolutely necessary. Their able engineer, Mr. Goddard, has taken care to supply them with stoves of the most efficient description, and has favoured us with engravings of his new Registered Asbestos Stove, which, unlike the ordinary stoves, gives that cheerful blaze, out of sight of which no Englishman is supposed to be capable of enduring a winter. Fig. 1 represents the stove, which has a burner of the gridiron form, over which is sprinkled a few asbestos shavings, which ignite and sparkle in a most warmth-suggestive manner. Fig. 2 shows the burner, and fig. 3 the same stove shut up. The backs and sides of these stoves are lined with porcelain, which reflects the heat, and is easily kept clean.

Fig. 1.

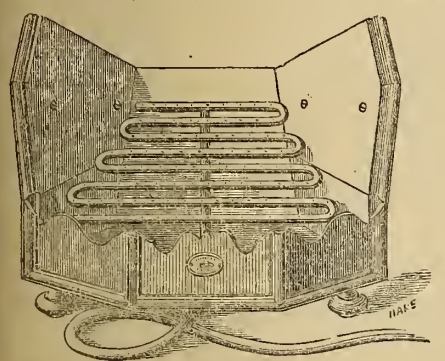


Fig. 2.

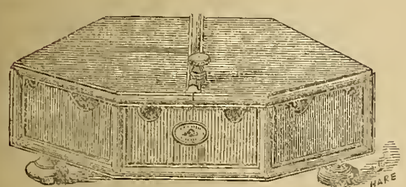
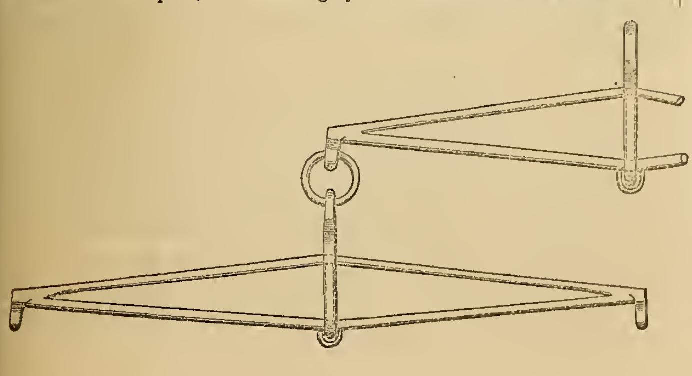


Fig. 3.

Any of our readers who have ever experienced the discomfort usually attendant on ordering "a fire to be lighted in my bedroom," will appreciate these smokeless, dirtless, and troubleless, gas stoves. They may be seen in operation in London at Messrs. Hare and Co.'s, Arundel-street, Strand.

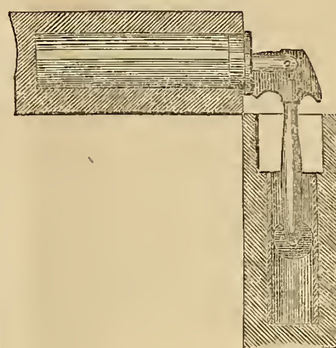
Wrought-Iron Whippletrees.—A very elegant adaptation of wrought iron was exhibited by Messrs. Ransome and Sims at the Lewes show, which we have engraved. The trussed form gives great strength with the minimum of weight, as compared with the clumsy wooden ones generally used, whilst the material, if galvanised, or kept well painted, is indestructible by fair usage. This invention received the Royal Agricultural Society's silver medal at Southampton, and was "highly commended" at Lewes show.



Savage's Invisible Door Spring.—This is a very simple and efficacious contrivance, and supplies a want which we have often experienced. A hole is bored in the jamb, into which is fastened, by a flange, a metal tube, shown in section in fig. 1, and an outside view in fig. 2. This contains a spiral spring, to which a rod is attached. A similar piece of tube is let into the door, and in it works a lever with a friction roller. The outer end of this lever is of a cam shape, and is connected by a joint with the spring. The face of the cam also runs on friction roller, and the shape of the cam is such, that the opening of the door extends the spring. A notch is made in the cam, which fits the roller when the door is at right angles to the jamb, as in fig. 2, and serves to hold the door open. The spring is easily fixed without disfiguring the door, and they can be applied to doors swinging both ways, so as to dispense with hinges altogether.

Fig. 1. Jamb. Door shut.

Fig. 2. Jamb.



Door open.

NOTES FROM CORRESPONDENCE.

*** We cannot insert communications from anonymous correspondents.

"J. G.," Halifax.—We should recommend him to make one of his indicators, as we think his plan a very ingenious one, but an adequate opinion of its real value can hardly be formed without actual trial.

"A Paper Maker and Constant Reader."—We can say nothing without seeing an indicator diagram, and knowing the present speed of the engine. An abstract of the specification can be procured for, say, a guinea. Our correspondent had better address direct.

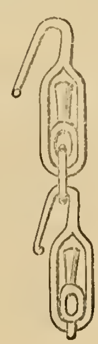
"L."—The plan alluded to is Pettitt's patent, dated, we think, 1843.

"G. W. H.," Birmingham.—We are informed that a factory for the manufacture of Colt's pistols is being established in London.

Greenstreet's Ornamented Zinc.—The zinc is etched with an acid, and colouring matter let in. The specimens we saw were hardly up to the mark, but experience will no doubt improve it. Our correspondent should see it, and judge for himself.

"C. E."—The facts are so evident, that we did not think it would have any useful effect to engrave the exploded boiler, but a sketch of it, and notes of the evidence on the inquest, may be inspected at our office.

"A Stoker" should have given his name. The only special work on the locomotive is the new edition of Tredgold, which we fear is too expensive for him. An English translation of a French work, entitled, the *Student's Guide to the Locomotive*, can be got for about 8*s*., but the illustrations are out of date by this time. Mr. Clark's work is worth his reading, if he can obtain the use of a copy.



Paddle and Screw Combined.—A correspondent has favoured us with a curious pamphlet, entitled *The Balance Engine*, by George Overend; in which the writer falls into the error of imagining that a single-acting engine will only burn half the fuel per horse power that a double-acting one does! He also proposes to add a screw propeller to a paddle-wheel steamer, but with characteristic perverseness, makes the steam from the paddle-wheel engines drive the screw engines. We do not think it likely that either Mr. Bourne or himself had any knowledge of each other's projects.

LIST OF ENGLISH PATENTS,

FROM 24TH OF JULY TO 19TH AUGUST, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Henry Bessemer, of Baxter House, Old St. Pancras-road, for improvements in the manufacture, refining, and treating sugar, part of which improvements are applicable for evaporating other fluids. July 24.

Henry Houldsworth and James Houldsworth, both of Manchester, silk manufacturers, for certain improvements in the fixing, extending, and holding of cloth to receive embroidery, and in apparatus applicable thereto. July 27.

James Denton, of Oldham, Lancaster, spindle and fly-maker, for certain improvements in machinery or apparatus for preparing cotton and other fibrous materials. July 29.

Frederick Winter, of Eldon-street, Finsbury, roche manufacturer, for certain improvements in the construction of machinery for supplying rotatory motion to carriages, vessels, and water mills. July 29.

John Martin, of Barmer, Norfolk, farmer, for improvements in implements for hoeing. July 29.

Auguste Edouard Loradoux Bellford, of Castle-street, Holborn, for certain improvements in the manufacture of sheet iron. (Being a communication.) July 29.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in the construction of taps and cocks for fluids and liquids. (Being a communication.) July 29.

Henry Wickens, of Carlton-chambers, Regent-street, Westminster, gentleman, for improvements in obtaining motive power. (Being a communication.) July 31.

Samuel Starkey, of Clapton, Middlesex, gentleman, for improvements in machinery for washing minerals, and separating them from other substances. July 31.

John Gerald Potter, of Over Darwen, Lancaster, carpet-manufacturer, and Matthew Smith, of the same place, manager, for certain improvements in the manufacture of carpets, rugs, and other similar fabrics. July 31.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the construction of wheels for carriages. (Being a communication.) July 31.

William Ackroyd, of Birkenshaw, near Leeds, for improvements in the manufacture of yarn and fabrics, when cotton, wool, and silk are employed. July 31.

William Hetherington, of Hansworth, near Birmingham, gentleman, for improved machinery for stamping or shaping metals. (Being a communication.) August 3.

Alfred Vincent Newton, of Chancery-lane, for improvements in the manufacture of metallic fences, which improvements are also applicable to the manufacture of verandahs, to truss frames for bridges and to other analogous manufactures. (Being a communication.) August 7.

Roger Hind, of Warrington, engineer, for certain improvements in the construction of machinery or apparatus applicable to weighing machines, weigh bridges, railway turntables, cranes, and other similar apparatus. August 7.

Alexander Mills Dix, of Salford, Lancaster, brewer, for certain improvements in artificial illumination, and in the apparatus connected therewith, which improvements are also applicable to heating and other similar purposes. August 7.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, patent agent, for improvements in the manufacture of manure. (Being a communication.) August 10.

Edward Joseph Hughes, of Manchester, for improvements in machinery or apparatus for spinning and weaving cotton, wool, and other fibrous substances, and also in machinery or apparatus for stitching either plain or ornamentally. August 10.

Robert Weare, of Plumstead-common, Kent, electrical engineer, for improvements in galvanic batteries. August 12.

Melchior Colson, of Finsbury-square, Middlesex, civil engineer, for certain improvements in the construction of vehicles. August 12.

Daniel Adamson and Leonard Cooper, of Newton-wood Iron-works, near Hyde, Cheshire, for certain improvements in the construction of steam-engines and steam-boilers, also in the method of using and rarefying steam, part of which improvements are applicable to marine, locomotive and other boilers, and marine architecture in general, as well as in cisterns, tanks, and articles of a like nature. August 12.

Richard Laming, of Millwall, Middlesex, chemist, for improvements in the manufacture and the burning of gas, in the treatment of residual products of such manufacture, and of the distillation of coal, or similar substances, and of the coking of coal. August 12.

Nathaniel Jones Amies, of Manchester, manufacturer, for certain improvements in the manufacture of braid, and in the machinery or apparatus connected therewith. August 12.

François Bernard Bekaert, of Cecil-street, Strand, for improvements in the manufacture of zinc white. (Being a communication.) August 12.

James Lowe, of Charlotte-place, Upper Grange-road, Bermondsey, mechanic, and Thomas Eyre Wych, of George-street, Mansion-house, London, gentleman, for improvements in propelling vessels. August 19.

William Palmer, of Sutton-street, Clerkenwell, Middlesex, manufacturer, for improvements in the manufacture of candles and candle-lamps, and in packing candles and night-lights. August 19.

Thomas Hunt, of Leman-street, Goodman's-fields, Middlesex, gun-maker, for improvements in fire-arms. August 19.

Henry Rawson, of Leicester, for improvements in preparing and straightening wool and other fibrous materials. August 19.

Henry Spencer, of Rochdale, Lancaster, manager, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other fibrous substances. August 19.

Charles Butler Clough, of Tyddyn Mold, Flint, gentleman, I. P., for certain improvements in machinery or apparatus applicable to the purposes of brushing and cleaning. Aug. 19.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, Middlesex, patent agent, for certain improvements in cutting schistus for slates. (Being a communication). August 19.

Samuel Nichols, of Coldham-street, Nottingham, mechanic, John Livesey, of New Lenton, in the same county, draughtsman, and Edward Wroughton, of New Lenton, in the county aforesaid, mechanic, for improvements in the manufacture of textile fabrics, and in machinery for producing such fabrics. August 19.

LIST OF SCOTCH PATENTS,

FROM 22ND OF JUNE TO THE 22ND OF JULY, 1852.

John Davie Morries Stirling, Esq., of Black-grange, N. B., for certain alloys and combinations of metals. June 22.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in separating substances of different specific gravities. (Communication.) June 23.

John Henry Johnson, of Lincoln's-Inn-fields, Middlesex, and of Glasgow, N. B., gentleman, for improvements in steam engines. (Communication.) June 28.

John Linton Arabin Simmons, of Oxford-terrace, Hyde-park, Middlesex, captain in the Royal Engineers, and Thomas Walker, of the Brunswick Iron Works, Wednesbury, Stafford, Esq., for improvements in the manufacture of ordnance, and in the construction and manufacture of carriages and traversing apparatus for manufacturing the same. June 28; four months.

Frederick Sang, of Pall-Mall, Middlesex, artist in fresco, for improvements in machinery or apparatus for cutting, sawing, grinding, and polishing. June 30.

Peter Bruff, of Ipswich, Suffolk, civil engineer, for improvements in the construction of the permanent way of rail, tram, or other roads, and in the rolling stock or apparatus used therefor. July 5.

George Laycock, of Albany, in the United States of America, dyer, but now of Doncaster, York, tanner, for improvements in tanning and unhairing skins. July 6; four months.

Robert John Smith, of Islington, Middlesex, for certain improvements in machinery or apparatus for steering ships or other vessels. July 7; four months.

James Higgin, of Manchester, Lancaster, manufacturing chemist, for certain improvements in bleaching and scouring woven and textile fabrics and yarns. July 8.

William Beckett Johnson, of Manchester, Lancaster, manager for Messrs. Ormerod and Son, engineers and ironfounders, for improvements in railways, and in apparatus for generating steam. July 12.

Richard Paris, of Long-Acre, Middlesex, modeller, for improvements in machinery or apparatus for cutting and shaping cork. July 12.

Peter Armand Le Comte de Fontainemoreau, of South-street, Finsbury, London, Middlesex, for improvements in the apparatus for kneading and baking bread, and other articles of food of a similar nature. (Communication.) July 13; four months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for cutting soap into slabs, bars, or cakes. (Communication.) July 15.

Richard Laming, of Millwall, Middlesex, chemist, for improvements in the manufacture and the burning of gas, in the treatment of residual products of such manufacture, and of the distillation of coal or similar substances, and of the coking of coal, and in the application of a certain substance which may be obtained from such treatment to the manufacture of paper. July 13.

William Reid, of University-street, electric telegraph engineer, and Thomas Watkins Benjamin Brett, of Hanover-square, gentleman, for improvements in electric telegraphs. July 19.

Emery Rider, of Bradford, Wilts, manufacturer, for improvements in the manufacture or treatment of India-rubber and gutta percha, and in the applications thereof. July 19.

Charles Augustus Preller, of Abchurch-lane, London, gentleman, for improvements in the preparation and preservation of skins and animal and vegetable substances. July 19.

Peter Armand Le Comte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in railways and locomotive engines, which said improvements are also applicable to every kind of transmission of motion. (Communication.) July 21; four months.

Joseph Maudslay, of the firm of Maudslay, Sons, and Field, of Lambeth, Surrey, engineers, for improvements in steam engines, which are also applicable wholly, or in part, to pumps and other motive machines. July 21.

William Septimus Losh, of Wreay Syke, Cumberland, gentleman, for improvements in obtaining salts of soda. July 21.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 166, Fleet-street, London, patent agents, for improvements in the purification and decoloration of oils, and in the apparatus employed therein. (Communication.) July 21.

Robert Hesketh, of Wimpole-street, Marylebone, Middlesex, for improvements in apparatus for reflecting light into rooms, and other parts of buildings and places. July 22.

Edward Maitland Staples, of Cheapside, for improvements in cutting mouldings, tongues, and other forms, and planing wood. July 22.

LIST OF IRISH PATENTS,

FROM THE 25TH OF MAY TO THE 16TH OF JULY, 1852.

Julian Bernard, now of Guilford-street, Russell-square, late of Green-street, Grosvenor-square, Middlesex, gentleman, for improvements in the manufacture of leather, or dressed skins of the materials to be used in lieu thereof, of boots and shoes, and in materials, machinery and apparatus connected with or to be employed in such manufactures. May 25.

Stewart M'Glashen, of Edinburgh, sculptor, for the application of certain mechanical powers to lifting, removing, and preserving trees, houses, and other bodies. May 26.

Joan Theodore Coupier, and Marie Amedée Charlies Mellier, both late residing at Maidstone, Kent, at present of Golden Bridge Mills, near Dublin, gentlemen, for certain improvements in the manufacture of paper. June 2.

Peter Fairbairn, of Leeds, York, machinist, and Peter Swires Horsman, of Leeds, aforesaid, flax spinner, for certain improvements in the process of preparing flax and hemp for the purpose of heckling, and also machinery for heckling flax, hemp, China grass, and other vegetable fibrous substances. June 3.

William Hindman, of Manchester, Lancaster, gentleman, and John Warburst, of Newton Heath, near Manchester, cotton dealer, for certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith. June 3.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 166, Fleet-street, London, patent agents, for improvements in presses and pressing, in centrifugal machinery, and in apparatus connected therewith, part or parts of which are applicable to various useful purposes. (Communication.) June 3.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 166, Fleet-street, London, patent agents, for certain improvements in the preparation and treatment of fibrous and membraneous materials, both in the raw and manufactured state, in applying electro-chemical action to manufacturing purposes, and in the manufacture of saline and metallic compounds. (Communication.) June 4.

William Cardwell M'Bride, of Alistragh, Armagh, farmer, for certain improvements in machinery for scutching, or otherwise preparing flax and other like fibrous materials. June 4.

William Watt, of Glasgow, Lanark, N. B., manufacturing chemist, for improvements in the treatment and preparation of flax or other fibrous substances, and the application of some of the products to certain purposes. June 15.

Richard Christopher Mansell, of Ashford, Kent, for improvements in the construction of railways, railway rolling stock, and in the machinery for the manufacturing the same. June 21.

John Harcourt Brown, of Aberdeen, and John Mackintosh of the same place, for improvements in the manufacture of paper and articles of paper. June 21.

Thomas Twells, of Nottingham, manufacturer, for certain improvements in the manufacture of looped fabrics. June 30.

Peter Bruff, of Ipswick, Suffolk, civil engineer, for improvements in the construction in the permanent way of rail, tram, or other roads, and in the rolling stock or other apparatus used thereof. July 16.

DESIGNS FOR ARTICLES OF UTILITY,

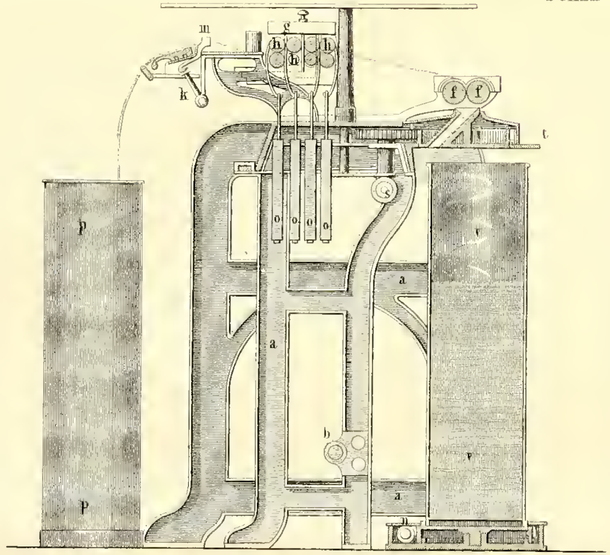
FROM 23RD OF JULY TO THE 19TH OF AUGUST, 1852.

July 23, 3341, T. A. Readwin, Winchester-buildings, "Revolving cutter and scythe-reaping machine."
„ 28, 3342, G. Whatton and D. Reading, Chambers-street, "Roller box for ships' blocks and various kinds of axles, &c."
„ 30, 3343, John Crosby, Fakenham, "Safety sea-bathing machine."
„ 30, 3344, Richards and Company, Bishopsgate-street, "Gold-washing machine."
„ 30, 3345, H. E. Thompson, Oxford-street, "Portable metallic bedstead."
August 2, 3346, G. B. Davies, Halifax, "Coat."
„ 3, 3347, W. Dray and Company, London-bridge, "Box-gearing."
„ 6, 3348, J. Lee, Birmingham, "Combination gold-digging tool."
„ 12, 3349, P. Rigby, Liverpool, "Washing apparatus for separating metals from sand, &c.
„ 12, 3350, H. Bennett, Liverpool, "Double diamond tooth for bone mills."
„ 17, 3351, S. R. English, Birmingham, "Embossing press."
„ 19, 3352, E. Goddard, Ipswich, "Gas stove."

COTTON DRAWING FRAME.

SCALE ¾ INCH=1 FOOT

SECTION



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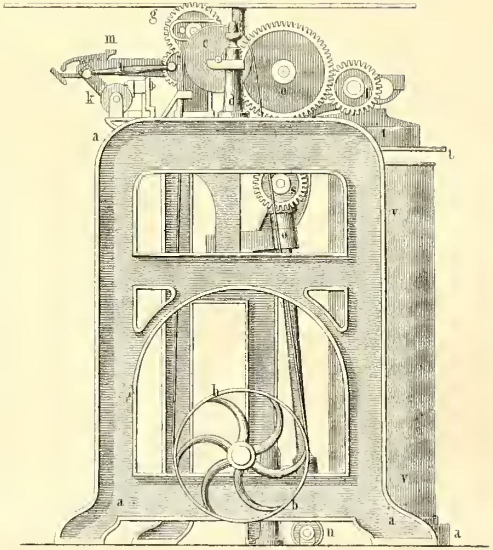
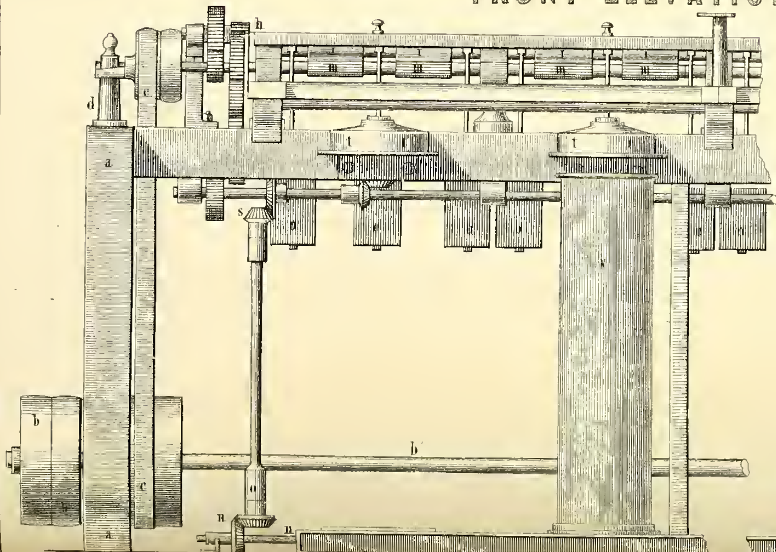
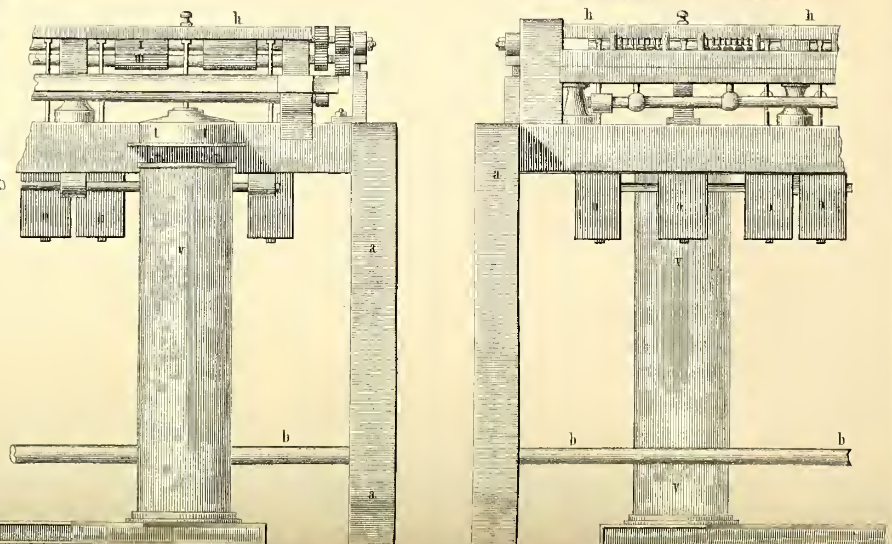


FRONT ELEVATION

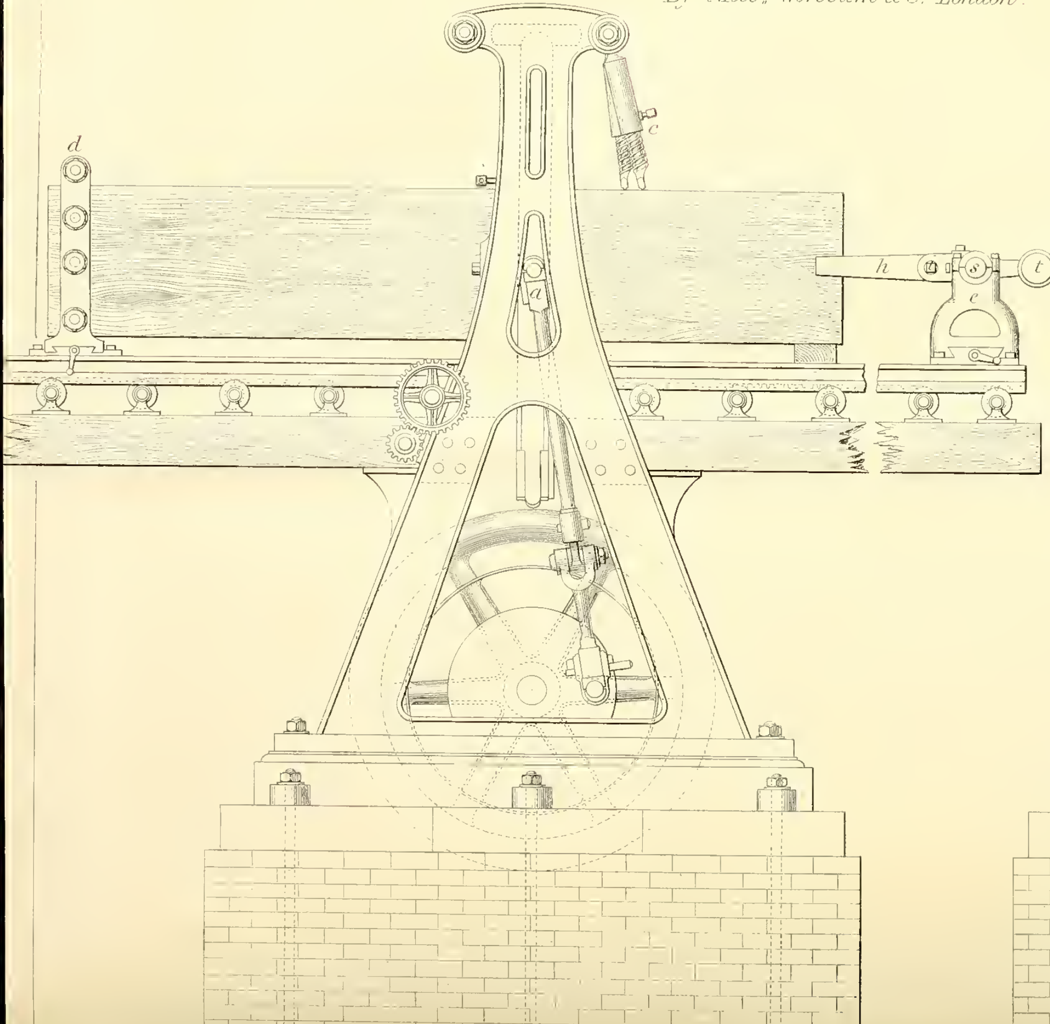


BACK ELEVATION

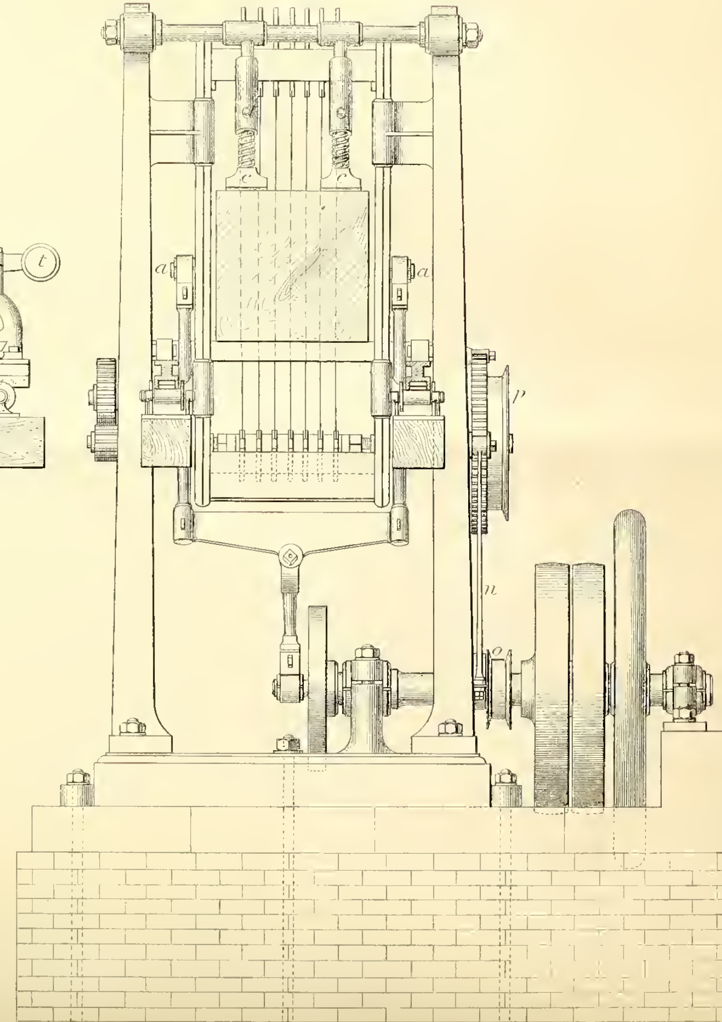


TIMBER-SAWING FRAME,

By Mess.rs Worssam & Co. London.



SIDE ELEVATION.



END ELEVATION

Scale ⅜ of an Inch to a Foot.

THE ARTIZAN.

No. X.—Vol. X.—OCTOBER 1st, 1852.

THE EVENTS OF THE MONTH.

RAILWAYS IN INDIA.

Upon the subject of improving the internal communication of India we have always endeavoured to keep our readers well informed, as well from a sense of its importance to the great manufacturing interests of this country, as from the conviction that a heavy responsibility rests upon those who, having conquered by the sword, rely upon it alone for the stability of their empire. Were the Anglo-Saxon race swept to-morrow from the face of India, what institutions, what public monuments, would survive to hand down to future generations a tradition of the glory of the present rulers of the East? With an immense revenue, unlimited power, and a certainty of a pecuniary return sufficient to satisfy the most exacting, we have done literally nothing for India, when its extent is taken into consideration. After ten years of talking, we can only show in India a few river steamers, and a few miles of half-finished railway. It is not our province to point out the causes which have led to such a state of things—a state which may be attempted to be palliated, but cannot be denied; we would rather cheer ourselves with the hope that the dawn of a brighter day is at hand, and that India is about to feel that revivifying influence which, it has been well said, has made Old England young again, and Young America a man.

Of the position and prospects of the established railway companies in India, we have but little to say. At Calcutta, Bombay, and Madras, short lines are in progress; but however valuable they may be, as affording a field for experience, they will exert little influence on the country at large until they are linked to the great marts of commerce in the interior. If the reader will turn to the *Artizan* for June, 1851, p. 121, he will find a *resumé* of the plans which were proposed to run from Calcutta. As will be seen by a reference to the map, the Ganges forms an arc, having Calcutta at one end, and Mirzapore at the other; the chord, a distance of 450 miles, being formed by the East Indian Railway, should that line ever be carried out on its original plan. As the Ganges is easily navigable as far as Mirzapore, this line will have to bear the competition of the river; but it will be some years before it has the chance even of doing that—so we may dismiss it for the present.

In the meantime, however, Upper India, the districts of the Upper Ganges and the Jumna, are left still dependent on the difficult and hazardous navigation of these rivers. Under these circumstances, a line has been projected, which, apart from the facilities offered for its execution by the nature of the country, has the singular advantage of connecting together, within a moderate distance, the important points, Allahabad (the confluence of the Ganges and Jumna), Cawnpore, Agra, and Delhi, with the opportunity of a continuation to Lahore and the banks of the Indus. As we have said, the country is remarkably favourable, the course lying between the Ganges and the Jumna. Indeed, when we read the report of the director of the railway department of the Indian government, Major J. P. Kennedy, the only wonder is, that the government did not make this the starting-point. He says, "Between Allahabad and Delhi there is no engineering question of difficulty whatever, as the beautiful flat bed (extending for several hundred miles in the direction of the line, in the Dooab, between the rivers Ganges and Jumna), with its numerous commercial towns, offers perhaps the most singularly inviting district for laying down a railway that can be found in the world, free as it is from inundation, from hills, from river-crossings—in short, from any impediment and almost every source of expenditure in railway construction."

We may compare such a line, in fact, to a "North-Western," having London, Birmingham, Manchester, and Liverpool for its termini, but without its enormous cost of construction—that millstone which sinks so many promising schemes. Like the tradesman (immortalised by Molière) who had lived forty years without knowing that he talked prose, railway promoters have only just found out that it is the *cost* of railways which mainly determines the rate of dividend which they will yield. The secret of the success of the American lines is their low cost; and if it be objected that the greater distance between the termini counteracts the economy of cost per mile, it is equally true that the railway improves so much the greater area, from which, when so improved, it will draws its traffic.

The following extracts from the prospectus of the company are, we believe, below the mark, instead of being above it:—

"Allahabad is an ancient and populous city of great fame and importance in the East. Crowds of pilgrims resort to its sacred shrines and temples; it is the *entrepôt* for the traffic by the steamers and the larger country craft, and is one of the principal civil and military stations. Cawnpore is the largest military station in India.

"There is, both by steamers and country craft, a continuous permanent water communication between Calcutta and Allahabad. The yearly tonnage of the lower Ganges is 1,500,000, by the country craft alone. The number of passengers is also very great. Deep water ceases at Allahabad, and, consequently, it is at this important city that the real difficulty and expense of transit begin; the sand-banks of the upper Ganges and the sharp ledges of rock of the Jumna rendering the navigation by even the smaller country craft slow and precarious.

"The insurance of merchandise and property from Agra to Allahabad, by the river route, in consequence of the danger and difficulty of the navigation, is as high as from Calcutta to England, the distance in the one case being 300, in the latter 15,000, miles.

"Above Allahabad, notwithstanding the defective river navigation, and the rude and expensive land carriage, which costs from 4*d.* to 8*d.* per ton per mile, moving at the slow rate of ten miles in twenty-four hours, there is an officially-ascertained traffic of above 1,000,000 tons, and a land-passenger traffic, by various conveyances, exceeding 100,000 per annum, besides passengers by boats, and about 300,000 travellers on foot."

BEET SUGAR MANUFACTURE,

WITH PLANS OF SUGAR WORKS, AS CONSTRUCTED BY M. DEWILDE, ENGINEER.

Translated for *The Artizan* from the French of M. Armengaud Ainé.
Illustrated by Plates 11 and 12.
(Continued from page 189.)

In order to give the reader a correct idea of the condition of the two great sugar-producing interests, we will lay down an estimate of the cost of production of sugar, both in France and in the colonies.

Cost of manufacturing beet-root sugar under favourable conditions of cultivation, rotation of crops, and coal:—

Beet-roots, 4,921 tons (deducting for the heads and leaves), at 5*s.* 6*d.* per cwt.		£2,708
Labour, 14,000 days' work (men, women, and children), at 7½*d.*		875
Coal, 1,500 tons, at 10*s.*		750
Bone charcoal		500
Interest:—		
Machinery, £6,250, at 10 per cent		625
Floating capital, £2,080, at 5 per cent. ..		104
Rent, repairs, management, and incidental expenses		1,032
		£6,594
Value of residuum to be deducted:—		
Molasses, 59 tons, at 7*s.* 7*d.* per cwt. ..	£450	
Scum, residue of charcoal	96	
Pulp, 1,107 tons, at 7*s.* 7*d.* per ton ..	422	
		968
Produce, 5,906 cwt., at 19*s.* 0¼*d.* per cwt. ..		£5,626

Cost:—		
One cwt. of sugar in factory ..	£0 19 0¼	
Carriage, storage, discounts, &c. ..	0 6 4½	
Duty, per cwt.	1 0 11¾	
		£2 6 4½
Selling price		2 10 9½
Profit per cwt.		£0 4 5
Profit in a season of 100 days		£1,312 10 0

When the selling price of raw sugar falls to £2 6*s.* 4½*d.* per cwt., there is no profit; but if the manufacturer prepares the sugar at once in loaves, by the aid of systematic liquoring, his expenses are scarcely increased, or, at least, are compensated in a great measure by the diminution of the expense of carriage, storage, leakage, &c.; and the difference in the selling price leaves a larger and more certain profit. In fact, instead of one cwt. of good raw sugar, he obtains—

89·6 lbs. of loaf sugar, value net		£2 14 2
12·32 „ (vergeoises) ..	£0 4 7¾	
10·08 „ molasses ..	0 0 11¼	
		0 5 7
		£2 19 9
Additional cost and duty		0 4 3
		£2 15 6
Deduct cost, as before		2 6 4½
Profit per cwt.		£0 9 1½

Or nearly double the former amount.

Let us now turn to the colonial sugar estate, the balance-sheet of which would stand somewhat as in next column.

CAPITAL.

371 acres (canes and vegetables for food)	£8,333	
150 slaves* at £45 16*s.*	6,875	
Buildings and cattle	3,125	
Interest on	£18,333	£916
Annual expenses		1,012
		£1,928

PRODUCE.

Sugar, 2,362 cwts., at 14*s.* 9¾*d.*	£1,749 0 0
Molasses and rum	179 0 0
	£1,928 0 0

The cost price, therefore, in the colonies, may be taken at 14*s.* 9·75*d.* per cwt. The carriage and leakage amount to 7*s.* 7·43*d.* per cwt. The tares, discounts, commissions, &c., to 5*s.* 6*d.*, and the duty to 20*s.* 11·43*d.*; in all £2 8*s.* 10·61*d.*, which is so near the selling price of the colonial raw sugar on an average, that scarcely any profit is left to the grower, and any fall in the market price entails a loss.

(To be continued.)

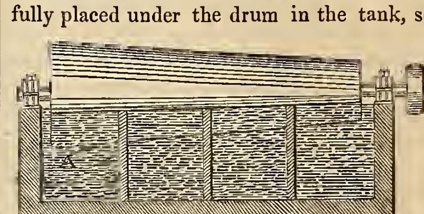
* The abolition of slavery will increase the price of labour in the French colonies, as it has done in the English.

NOTES ON THE BEET ARTICLE IN THE NO. OF JULY, 1852, "THE *ARTIZAN*,"

By E. Burel, C.E.,

IN THE DESCRIPTION OF THE WASHING PROCESS.

"Instead of inclining the cylinder, it may be made of a conical form, *which produces the same effect.*" This, on the contrary, was a decided improvement (brought out, I think, by Crespil, if I recollect well), for the difference of speed applied to the process, from the beginning to the end of the conical drum, assists the mud and other impurities to fall freely during the former revolutions of the roots, where they run slowly; whereas, when they come to the further end, they meet with cleaner water, through which they pass quicker, the consequence being an increase of the cleaning power by the increase of friction. Another advantage is to admit of the axle being set horizontally, and close to the water throughout its whole length, as near as to clear the bearings. Partitions are likewise admitted to be more successfully placed under the drum in the tank, so as to separate the muddy parts, and prevent them from mixing, from one end to the other. The last division, A, is constantly supplied with a spring of fresh water, while the dirty one is escaping under its natural pressure. The cylindrical plan is now entirely given up.



A very important and valuable pattern of press is omitted in the article; that is, the one patented by M. Facquet Ainé, of Arras, in 1850. Its peculiarity lies in the performance of the process of squeezing within a closed apparatus, thus doing away with the mode of putting the pulp into bags. The press is composed of a cylinder, standing in the middle of the four columns, and open at both ends. The one at the bottom rests upon its edge in such situation as to correspond to the piston (made to fit); the top end is terminated by a flange distant about 10 inches from the crown-piece of the press. A ring little less than 10 inches, to complete the space, is fitted to that flange, in such a way as to be easily disconnected, and removed instantly.

Suppose now, this additional ring to be removed from the press; the

cylinder is filled up with pulp; the additional ring is fitted up likewise with a temporary bottom, made of a plain sheet of iron. It is then put on in its place, the false bottom removed by sliding, and transposed to the top, close to the crown-piece. This is done with a perfect facility, by means of a side lever assisting these different motions. The performance of the press is thus easily understood. The piston rises and squeezes the pulp, when the juice exudes through the numerous apertures provided in the best situation throughout the entire surface, but not large enough to allow the pulp itself to escape. After the pressing is finished, the additional ring is removed, and a few strokes of the pump push out of the cylinder the dry pulp, which is taken away in a lump; then the piston is allowed to go down, and whatever may be the time of its descent, this time is not lost, as the cylinder may be filled up again while the piston is going down.

COTTON AND ITS MANUFACTURING MECHANISM,

By Robert Scott Burn, M.E., M.S.A.

(Continued from page 172.)

In plate XV. we give a series of sketches of the "drawing frame," reduced from plans furnished us by Mr. Mason, of Rochdale; they comprise end, back, and front elevations and section. The operation of the machine, the *rationale* of which we have already described, may be gathered from an inspection of the drawings and the following brief description. In the section, the sliver from the can, *p p*, taken from the carding engine, is delivered to the set of drawing rollers, *h h*, the lower ones of which are fluted, as at *m m*, in the front elevation, and the upper ones, *i i*, covered with leather; the rollers are cleaned from their adhering wool, by means of the clearer board, *g*, the under side of which is covered with flannel and rests in contact with the upper rollers. The sliver, after being drawn, is passed to the calender rollers, *f f*, from between which it passes to the presser plate, *t t*, which is made to revolve by the lying shaft, *s s*, furnished with appropriate gearing; the sliver, after passing from the plate, is coiled within the can, *v v*, which is kept revolving by the gearing on the low shaft, *n*. In the event of any of the slivers breaking in the passage from the can, *p p*, to the rollers, *h h*, the machine is instantaneously stopped by a very ingenious and simple mechanism, known as "Houldsworth's Patent Stop Motion." A lying shaft at *k* (see end elevation), is made to oscillate, or have an alternate motion, by means of the crank *k*, and small connecting lever *h*; a brass lever, *m* (section), is nicely balanced at the side of the frame; the top part of this lever is furnished with a flat groove, over which the sliver passes; as long as the connection is kept up between the rollers, *h*, and can, *p*, by means of the sliver, the friction of the passing sliver keeps the head of the lever, *m*, up; but as soon as the sliver breaks, the lever, *m*, drops, the hook at its lower end catches the alternating lever, *k*; this throws forward a fork lever, which passes the driving-belt from the fast to the loose pulley; the whole range of rollers is thus stopped, until the attendant pieces up the broken ends, and starts the machine by passing the belt from the loose to the fast pulley. This immediate stoppage of the *whole* set of rollers is desiderated from the fact, that the uniformity of the slivers thereafter passed to the machine next in sequence would be much impaired, from one *can* having more material than its neighbour. Such is the advanced state of the manufacture, that every stage is reduced to such a matter of exact calculation, that the failure of any one, even of what might be looked upon as of minute importance, deteriorates and damages the perfection of the after processes. The manufacture may be likened to a chain, the failure of the smallest link of which impairs its working efficiency. The following brief reference to the drawings in the plate may be useful still further to elucidate the operation of this machine. In the "end elevation," *a a* is the framing, *b b* the fast and loose pulley on the main driving-shaft, *b*¹ *b*¹; motion is given to the speed pulleys, *c*, on the standard, *d*, by the strap, *c* (front elevation); the presser plates are driven by bevel gearing, *s s*, on the lying shaft beneath the framing, driven by means of the gearing, *e e f* (end elevation). The cans, *v v*, receive motion from the lying shaft, *n n*, driven by bevel gearing on the vertical shaft, *o o*, which derives its motion from the presser wheel driving-shaft by the mitre-wheels, *s s*; weights, *o o*, give the necessary pressure to the sliver as it passes through the drawing rollers. From the small space at disposal, part only of the back elevation has been given.

A few historical notes relative to the introduction and invention of the two last machines treated of—the carding-engine and drawing-frame—may not be uninteresting to many of our readers. The original carding apparatus in use in the primitive days of cotton manufacture was very simple; the cotton was spread upon the surface of a series of teeth projecting from a piece of wood; another similarly-furnished piece was used to comb the cotton thus placed between them. The operation was repeated until the fibres were all lying, as near as could be effected, parallel to one another. This method, so far as correct information has been obtained, is supposed to have been in use up to about 1779. It was in 1748 that the first grand improvement in the process was effected, which placed it on a permanent and efficient basis. This improvement was carried out by Lewis Paul, of Birmingham, who patented it on the 30th of August of the above-mentioned year; it consisted of the application of rotatory power to the carding-teeth and surfaces. This formed the key to all the improvements which have since been effected in this beautiful machine. The card fillets were placed lengthways, in strips, on the surface of a cylinder, to which motion was imparted by a winch or handle. Beneath the cylinder, a concave frame, lined internally with cards, and fitting exactly the lower half of the cylinder, is placed. The wool was passed between the surface of the cards upon the cylinder and those contained in the concave frame, and when the handle was turned, and the cylinder put in motion, the cards upon the cylinder and concave frame worked against each other, and carded the wool. The wool was stripped from the cylinder "by means of a stick with needles in it, parallel to one another, like the teeth of a comb." These are the words used in the specification. And this needle-stick, and the stripping-comb of the present day, are identical, beyond mistake; in fact, as before stated, Paul's carding-engine is in principle the same as that now in use, with this difference, that the concave frame of flat cards is now placed above, instead of beneath, the carding cylinder. Obvious as are the advantages to be obtained by the use of this machine over the slow and defective process of "stock-cards," it is to be noted, that it had been patented twenty years before it had come into practical use. It was not introduced into Lancashire much before 1760. One of the first was erected for Mr. Peel, of Blackburn, by James Hargreaves, the inventor of the spinning-frame. This machine, it appears, had two or more carding cylinders working in contact; more work was thus done in a shorter time; but both the feeding of the cotton and the taking off the carded fleece were performed by hand. In Lewis Paul's machine, the length of the fleece was only equal to the length of the cylinder. To join these separate pieces into a perpetual card, he placed them in a flat broad ribbon, which was extended between two short cylinders, and which wound upon one cylinder as it unwound from the other. When the carding was placed in the ribbon, the turning of one of the cylinders wound the ribbon and carding upon it; and length being joined to length, the carding was made perpetual, and wound up in a roll ready for the spinning-machine. The defects of Paul's machine were the want of a self-acting feeder, by which the cotton could be applied continuously and regularly to the carders. Again, the "needle-comb," was moveable, this taking the cardings separately as the cylinder was filled. The machine only worked at intervals. The next improvement recorded is

that of a John Lees, of Manchester, and consisted of the adaptation of an endless feed-cloth, continually moving. A given weight of wool being spread on this, it was carried forward, and the carder supplied continuously. The celebrated Sir Richard Arkwright next essayed his improvements, and in 1775 he took out his patent for the same. The cotton was supplied continuously from the surface of a cylinder, round which it was lapped, and which revolved slowly on its axis; a second carding cylinder was also added, this revolving in a contrary direction to the main one, but having their teeth in contact. The cotton was stripped from off the main cylinder, and delivered in a continuous fleece. Much uncertainty prevails as to whether Arkwright did really invent this last improvement, inasmuch as there appears evidence to prove that two manufacturers used a finishing card completely covered with teeth, by which the fleece was perpetual, at least the year before Arkwright took out his patent. This important addition was termed a "doffer," or "finishing cylinder;" it is now universally known by the former name. The beautifully-effective method of stripping the fleece from the doffer cylinder, by means of the crank and comb previously described, has also been claimed by Sir Richard Arkwright as his invention: he claimed it, at all events, in his patent of 1755. The other claimant is James Hargreaves, the inventor of the spinning-jenny; but the recorded evidence, we think, goes to prove that Sir Richard was the inventor; at least, this merit must be allowed to him, that he brought his usual talent and judgment in combination to bear upon the successful practical adaptation of the carding-engine, with all its improvements; and in this he fully succeeded.

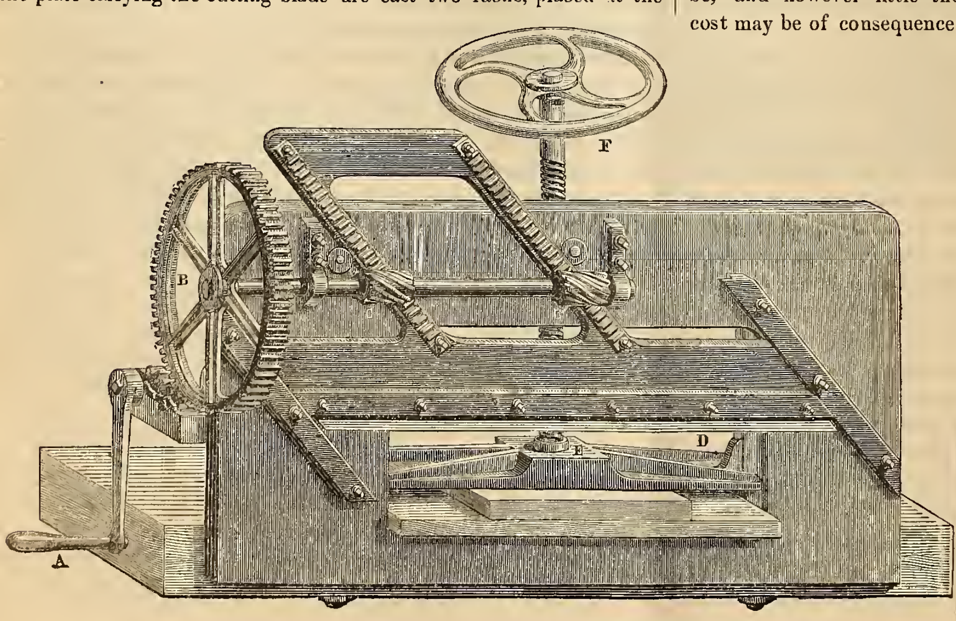
(To be continued.)

BOTTIER'S PAPER CUTTING MACHINE.

At page 4 we have given an engraving of Day's Patent Cutting Press, in which the knife moves radially in the segment of a circle. This is not the best arrangement possible, but a parallel motion involves difficulties of manufacture not so easily overcome. A very elegant modification, however, is constructed by M. Bottier, of Paris, of which we give an engraving in perspective. In this machine, which is in general use in France, the knife is always parallel with the table, but it has a "drawing cut" imparted to it by its also having an oblique motion, as will be readily seen. The steel cutting blade, D, is held firmly by set screws in a cast-iron plate, as is usual, which is guided by two adjustable dovetail guides, fixed obliquely to the frame of the machine. On the plate carrying the cutting blade are cast two racks, placed at the same angle as the guides, and motion is communicated to them by the pinions, C C, by means of the wheel B, and a pinion worked by a handle A. The pinions, C C, are of such a form and width, that the horizontal motion of the cutter does not draw the racks out of gear.

The paper, or other material to be cut, is held firmly on the table of the machine by the plate, E, which is moved by the screw and handwheel, F, as in an ordinary screw press.

This press appears to us to combine all the advantages that can be desired, whilst, from the nature of the motion of the knife, the edge of it is preserved.



STEAM BORING-MACHINE FOR MINES, QUARRIES, &c.,

BY M. CAVE, ENGINEER, PARIS.

The reputation of M. Cavé as an engineer is well known, and he has lately turned his attention to the subject of boring, for mining and similar purposes, by steam or other power. Those of our readers who are practically acquainted with mining operations are well aware of the important benefits which a good mechanical system, as a substitute for manual labour, would confer both on the working miner and the adventurer. In hard ground, the expense of sinking a shaft or driving a level is almost incredible. The presence of impure air, the confined space, and the want of light, all combine to limit the efficiency of the miner, whilst the impossibility of more than three or four men working at one end prevents the work being pushed forward with any greater rapidity, however important the object to be gained may be, and however little the cost may be of consequence.

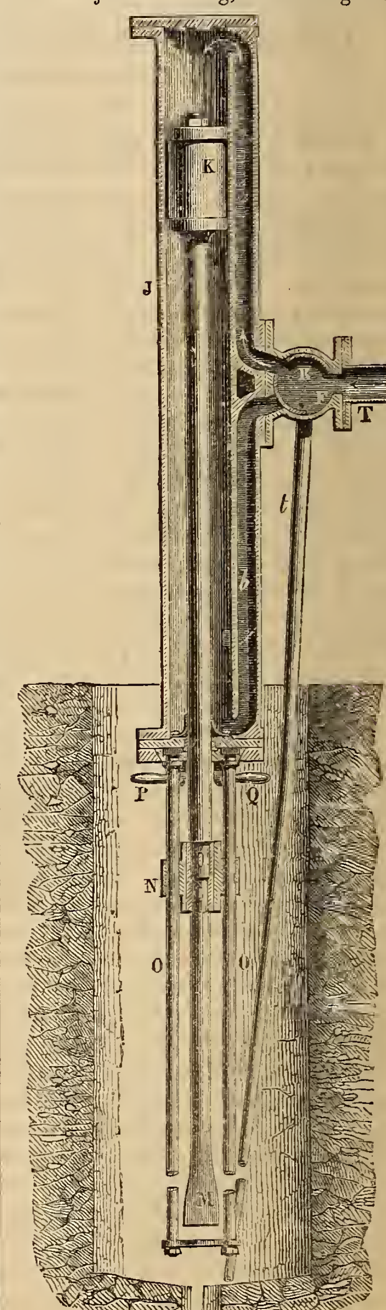
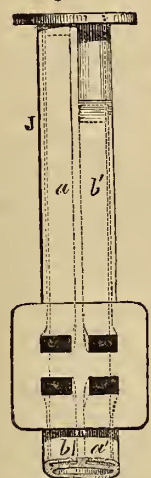


Fig. 1.

In metal mines, the cost of extraction does not bear so large a proportion to the value of the material raised as it does in coal mines; and attempts have been made in the latter to use circular revolving cutters, so as to bring out the coal in rectangular masses, which would increase its value in point of stowage, and also, we are inclined to think, preserve its evaporative powers. There is a very manifest deterioration in the quality of coal when it has been broken up and exposed to atmospheric influences, which immediately occurs to a person visiting a coal district, and witnessing for the first time the rapidity and brilliancy with which the fresh-raised coal inflames.

For the great majority of mining, quarrying, and tunnelling operations, boring and blasting is employed; and it is for this object that M. Cavé's machinery is designed.

Fig. 3.



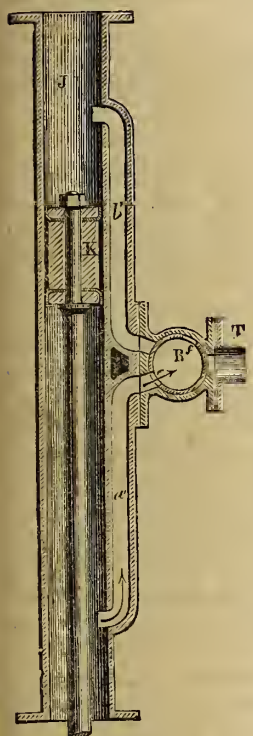


Fig. 2.

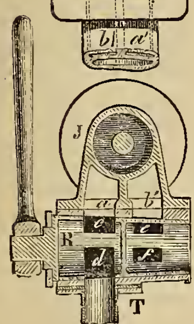
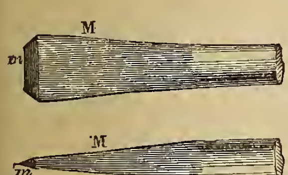


Fig. 4.

It consists of a cylinder and piston, actuated by steam, compressed air, or by the vacuum system, the cutting tools being attached to the piston-rod, and acting by percussion. It thus resembles a Nasmyth's steam-hammer; and a similar means is employed to destroy the momentum of the piston, by enclosing a portion of steam or air, which acts as a cushion at each end of the cylinder. To carry out this purpose, the inlet and exhaust passages are kept quite distinct, as will be seen on referring to the drawings.

Fig. 1 is an elevation of the machine in section through the inlet passages; fig. 2 is an elevation of the cylinder in section through the outlet passages; fig. 3 is a front elevation, showing the passages; and fig. 4 is a plan in section through the passages. J is the cylinder, containing the piston, K, to the rod of which is attached a cross-head, N, to which is also fixed the chisel, M. The cross-head and chisel are guided by the guide-rods, O O, which are fixed in a plate dovetailed into the cylinder cover, in such a manner, that it can be freely turned round (with the piston) by means of the handles, P Q, and thus enable the chisel to take a fresh cut at every stroke, without which it would jam. The annexed sketches show the shape of the chisel and its cutting edge.



The admission and emission of the compressed air or steam is regulated by a four-way cock, R, supplied by a pipe, T, as shown in fig. 1. The air is admitted through the inlet passage, a, on the top of the piston, which will rapidly descend, until it passes the outlet a', fig. 2, when, the further escape of air being prevented, the piston is stopped by the air-cushion. On the up-stroke, the cock having been turned, the compressed air enters by the passage b, and escapes by the passage b'. It will be observed that the plug of the cock is divided transversely by a diaphragm, shown in fig. 4, to keep the passages distinct, c and d answering to the two inlet passages, and e and f to the two outlets.

The air which escapes from the cylinder is led by the pipe t to near the point of the chisel, and will have the effect of blowing away the small chips loosened by the chisel.

The machine is shown in the engraving as working vertically; but it could obviously be applied to driving a level, by placing it horizontally and mounting it on a carriage.

If it be desired to bore a hole of larger diameter than the width of a chisel, the cutter can be fixed at any desired distance from the centre of the piston-rod, the revolution of which will cause the cutter to describe a circle of corresponding diameter.

For sinking shafts, a number of cylinders might be employed simultaneously, working a sufficient number of chisels to extend round the shaft; and the same arrangement applied horizontally would serve to drive a level. In vertical boring, the chisels have to be regularly withdrawn, in order to permit of the extraction of the *débris;* but we do not find that the author has provided any special means for effecting this object.

He has suggested that electro-magnetic power may be applied to work this machinery; but air appears to offer the most tangible advantages. It can be conducted a great distance without suffering condensation, as steam does; and it would materially improve the atmosphere of the mine, by blowing in fresh air, or, if worked on the vacuum system, it would be equally advantageous in coal mines, by serving to draw off the fire-damp. Although M. Cavé has patented this arrangement, we are not aware if it has been practically applied. We foresee some difficulties, but we apprehend they are not beyond the ingenuity of our Cornish miners to overcome.

ON THE USE OF AIR-VESSELS IN PUMPS.

Some experiments have been made by Messrs. Kirchweger and Prusman, engineers, of Hanover, on the positive effect produced upon the action of pumps by the application of air-vessels on the suction pipes. Air-vessels have been applied for many years on delivery pipes, but it is only lately that their value has been properly estimated, although it is obvious that it is of as much importance that the pump should be filled with water, as that the delivery should be constant.

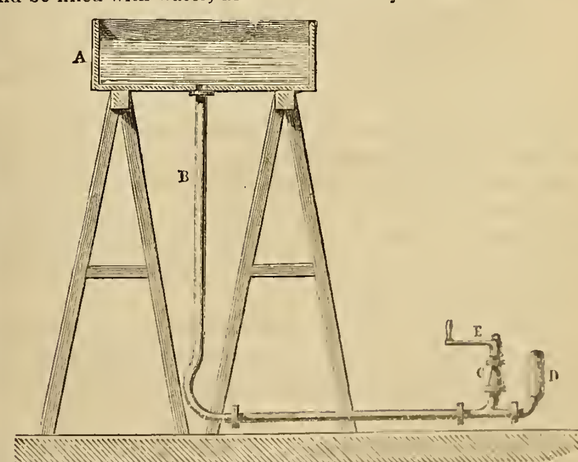


Fig. 1.

The apparatus employed by the German engineers is represented in section in fig. 1. A is a reservoir, which represents the source whence the pump draws its water, B is the suction-pipe, and C is a valve-chest, containing a ball valve, surmounted by a cock discharging at

the side. The plug of the cock is stationary, whilst the shell is moved by the handle E. D is the air vessel. Fig. 2 shows the details of the valve on a larger scale.

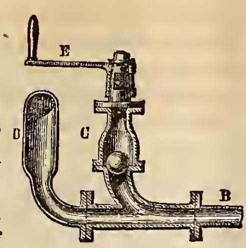


Fig. 2.

It is obvious that, by causing the cock to revolve by means of the handle E, a certain volume of water will escape each time the passage is opened, the height of water column in the pipe, E, answering to the pressure of the atmosphere in causing the water to fill the pump.

The result of the trials was that, when the air-vessel was removed, and the opening stopped, an increased velocity of rotation of the cock gave less water; but with the air-vessel the increase of velocity gave more water.

The trials were made with different speeds and different pressures of water, with the results shown in the following table :—

No. of Turns per Minute.	Gallons of Water delivered per Minute, under a Mean Pressure of			
	17 feet.	$12\frac{1}{2}$ feet.	$8\frac{1}{2}$ feet.	$2\frac{3}{4}$ feet.
With air-vessel				
80	12·9	12·78	8·79	2·83
100	15·6	15·43	11·25	4·82
120	17·15	16·63	12·23	5·44
140	18·28	16·75	12·98	5·54
Without air-vessel				
80	9·45	8·62	6·902	2·36
100	8·03	8·08	6·05	1·98
120	6·55	6·54	5·42	1·88
140	5·42	6·29	5·17	1·51

The capacity of the air-vessel is 66 cubic inches.

The weight of the ball-valve 2·315 lbs.

The area of the valve-seat = 11·5 inches.

The smallest diameter of the feed-pipe is 1·48 inches.

The quantities delivered at 80 to 100 turns are the mean of four trials; those of 120 and 140 turns are the mean of 3 only.

If these trials are to be taken as the exact result which may be expected under similar circumstances with a pump, it is evident that a large increase of duty may be expected, by adding an air-vessel on the suction side of a pump, working at a high speed. For, it will be observed that, whilst at 80 turns the increase is only 20 per cent., at 100 turns it is 133 per cent., at 120 turns 189 per cent., and at 140 turns, 266 per cent.

We have our doubts how far this would apply to a pump, and we should have preferred seeing a direct experiment on a pump. Such a trial could easily be made on a locomotive, by lifting it off the ground, running it various speeds, and watching the time occupied in filling up the boiler, with and without an air-vessel. Messrs. Kirchweger and Prusman, acting on these experiments, have applied air-vessels to locomotive feed pumps with good results.

Very little attention has been paid by engineers generally to the question of the proper area of valves, and there is a good deal of truth in the following remarks on this point by the reporter of the Jury, Great Exhibition.

"Notwithstanding the great antiquity of the pump and its extensive use, it is one of our worst machines, considered in a mechanical sense, as a means of producing a given result with the least possible expense of power. Simple as it is in construction, it appears, from the experiments of M. Morin, that the amount of power *lost* in lifting and forcing pumps (such as fire engines, &c.) amounts to *from* 55 *to* 80 *per cent. of the whole;* so that, of the work (in pounds one foot high) done by the motive power to drive the pump, only 45 per cent. in the best, and 18 per cent. in the worst, pumps, is found to be yielded, when the weight of water actually raised in pounds is multiplied by the height to which it is raised in feet, the rest of the work being lost in the passage of the water through the pump. This fact cannot be too distinctly stated. There are hydraulic machines which yield in the water raised from 75 to 80 per cent. of the work done to raise it, and 60 per cent. is a common proportion ; but so imperfect an instrument is the lift and force pump, that the best yields only 45 per cent., the average not yielding more than 36 per cent.; so that, if that pump could be so improved as to be no more wasteful of power than a well-made water-wheel, or a turbine, or Mr. Appold's centrifugal pump, then the same power applied to it would raise from a given depth nearly twice the amount of water that it now does. The causes of this loss of power are to be sought—

"1st. In the small size and the peculiar construction of the valves.

"2nd. In the proportion of the section of the barrel to that of the suction and force pipes.

"3rd. In the form of the suction pipe at the extremity, where the water enters it, and of the force pipe at the extremity, where the water is discharged.

"4th. In the forms of these pipes where they unite with the barrel.

"5th. In the proportion of the length of the barrel to the depth from which the water is raised.

"It is impossible to say to what extent the loss of power due to these causes may be removed, without experiments directed expressly to that end; this much is, however, certain, that it would be sensibly diminished by increasing the size of the valves, or by any other expedient which should diminish that sudden variation in the section of the stream which the valves create. That variation, attended as it is by a corresponding sudden variation of the velocity of the stream, involves a loss of power varying as the square of the difference of the two velocities, and dependent, therefore, on the ratios of the sections of the suction pipe and force pipe to the section of the barrel. From inattention to this arises the second source of loss of power we have enumerated. It is well known that the form of the nozzle by which water is discharged from a force pump influences largely the amount of the discharge; but it is not equally well known that the form of the extremity of the suction pipe by which the water enters has an equal effect in facilitating its ingress. A similar remark applies to that extremity of each pipe by which it communicates with the barrel, and the neglect of it accounts for a fourth source of the loss of power in pumps. A fifth cause, to which attention appears not hitherto to have been directed, is the loss of power due to the communication of an unnecessary velocity to the water raised. Any one who gives a succession of quick strokes to the piston of a common suction pipe, allowing sufficient time between for all the water which can find its way into the barrel to enter it, will find the discharge per stroke to be considerably greater than when the piston is raised slowly. The reason of this is obvious—a certain amount of power, and no more, is required to be done on the piston, in order to raise enough water from the well to fill the barrel. If more than this is done, the surplus manifests itself under the form of *vis viva*, communicated to the water by which *vis viva*, if space be afforded for it to take effect (as in a common suction pump, by efflux from the spout, or by the raising of the valve in the bucket), more water is brought into the barrel than is due to the volume generated by the piston. Half the *vis viva* of the water under the piston at the end of the stroke measures this surplus work.

"If a sufficient pause be allowed, and if the head of water above the piston be not considerable, as in the common suction pump, the upward rush of the water beneath it at the end of the stroke will lift its valve, and a portion of the surplus work (represented by half the *vis viva*) will take effect in the elevation of more water into the barrel than would fill the space generated by the piston; and thus is explained the fact of the greater discharge from such pumps, when worked by quick strokes with intervening pauses, than when worked slowly. If the head of water above the piston be, however, considerable, as in the force pump, any *vis viva* which may remain in the water at the end of the stroke will produce a shock, and a corresponding loss of power. This shock, commonly experienced in the action of force pumps, is accompanied by a violent and prejudicial action of the valves, especially when they are of metal. When the down stroke of the piston follows so rapidly on the up stroke as to meet the ascending stream produced by the preceding stroke, the resistance to its descent is increased, as well as the loss of power due to the commotion of the particles of the fluid it traverses.

"It is obvious, therefore, that the proportions of a pump, to be worked by a given motive power, should be such, that the power to be expended at every stroke may just bring the water raised to rest at the end of each stroke.

"It is immaterial in what proportions this work is distributed over the stroke, or under what varying degrees of pressure it is generated, provided that the pressure never exceeds that of the atmosphere on the surface of the piston. If this pressure be exceeded, the piston may separate itself from the water beneath it in the barrel, the pump drawing air; and this is more likely to occur at the commencement than at any other period of the stroke, the motion of the water at that point being necessarily slow.

"To communicate a finite velocity to the water at the commencement of the stroke, or while the space described by the piston is still exceedingly small, requires a much greater pressure than afterwards; and the greater as the section of the suction pipe is less as compared with that of the barrel, and as the lift is greater. Thus, at the commencement of the stroke, a finite velocity of the piston can only be obtained by an extraordinary effort of the motive power, associated with the chance of drawing air and of a shock, if the pressure be suddenly applied. A remedy for some of these evils in the

working of a pump has been sought in the application to it of a second air vessel, communicating with the suction pipe immediately below the barrel, or with the top of the suction pipe and the bottom of the barrel. The commencement of each stroke is eased by a supply of water from this air chamber to the space beneath it. The influx of the water into that space is aided by the pressure of the condensed air in the air chamber; and when the stroke is completed, the state of condensation of this air is, by the momentum of the water in the suction pipe, restored; causing it to rush through the passage by which that pipe communicates with the air chamber. Thus, by this contrivance, the surplus work, or half the *vis viva* which remains in the water of the suction pipe at the conclusion of each stroke, is stored up in the compressed air of the air chamber, and helps to begin the next stroke of the piston.

"The nature of this action will be best understood from that of the hydraulic ram. The contrivance, constitutes, indeed, in some respects, a union of the action of the ram with that of the pump; and, besides accomplishing the object for which it was applied, appears to have the effect of considerably economising the power employed in working pumps."

TIMBER SAWING FRAME,

CONSTRUCTED BY MESSRS. WORSSAM AND CO., ENGINEERS, LONDON.

(Illustrated by Plate 17).

So little information has been published on the recent improvements in sawing machinery, that we esteem ourselves fortunate in being able to present our readers with details of some of the most modern machinery constructed by a firm who have made this branch of engineering the especial object of their attention.

The drawing is so self-explanatory, that it leaves little to be said. We need, therefore, only enlarge on those points which demand particular notice.

In arranging the building for a heavy timber frame, the foundations are ordinarily a very heavy item, from the great depth required by the length of the connecting rod; and if this is curtailed, the evil is entailed of excessive friction on the guides. In the case before us, the makers have sought to reduce the height of the machine, by making the connecting rod forked, so as to embrace the frame, to both sides of which it is attached at the points, *a a*. To admit the vibration of the connecting rod, the guides are suitably overhung.

In the guides themselves, especial attention has been directed to diminish the friction, which, in surfaces moving at such a high velocity, consumes a large proportion of the applied power.* With this object, the back and front guides are not both V-shaped, as usual, but whilst the working side is made so, the other side is made flat, and has a brass plate pressed in contact with it, by means of a steel spring, set up by adjusting screws to the exact pitch to keep the frame from chattering.

The lower saw buckles are of S shape, and hook on to a projecting feather on the frame. They are set up sideways by a longitudinal screw, passing through all the distance pieces, but not through the saw buckles, so that any saw can be taken out in a few minutes.

The timber is prevented from rising, when the saws are entering, by the two legs, *c c*, which are screwed (with double threads) into sockets hanging from one of the strong distance pieces, between the sides of the framing. When adjusted to the proper length, they can be fixed in position by set screws.

Provision is made for setting the log transversely. The frames, *d* and *e*, on which the ends of the log are carried, are fitted up in the slide-rest style, and can be shifted by the screws across the rack-bed. They are made to suit the varying widths of timber, by one of the arms, *h*, being made a fixture on the shaft, *s*, whilst the other slides on the shaft, and is moved by a screw, *i*, to give the requisite grip of the wood. A balance-weight, *t*, facilitates the adjustment. The other end, *d*, is provided with set screws for the same purpose.

The feeding-motion is as usual; the eccentric rod, *n*, taking on to a ratchet-wheel, for the feed, and a strap between the riggers, *o* and *p*, giving the quick return motion for the rack.

In an ensuing number we shall give details of the planing machinery constructed by the same engineers.

* If some of our readers could give us particulars of the indicated power required to drive saw-frames, with and without the work on, they would oblige numerous correspondents who have applied for information.

GALLOWAY'S PATENT IMPROVEMENTS IN ENGINES AND BOILERS.

We were much gratified, a few days since, by an inspection of the improvements which have been effected by Messrs. Galloways, of Manchester, at the zinc mills, City-road. The steam power consists of a pair of 40-horse engines; cylinders, 34 inches diameter and 6 feet stroke. They were formerly driven by three Butterley boilers, and made only 16 revolutions per minute, which was insufficient to overcome the severe work which the heavy rolls threw on the engines. The old boilers have been replaced by two of Messrs. Galloways' conical water-tube boilers (*vide Artizan* 1850, p. 101); the valves have been altered, and a throttle-valve added on their patent plan. These improvements have effected a most remarkable result, which is best shown by the accompanying indicator diagrams, with which we have been favoured by Mr. R. Armstrong, C. E., under whose surperintendenee the alterations have been executed.

Fig. 1 is a diagram from the engines before they were altered, the speed being 16 revolutions per minute, and mean pressure 10·68 lbs.,

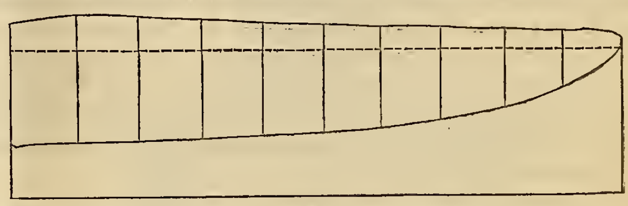


Fig. 1.

giving an indicated power of 115 horses. Consumption of coal, 6 lbs. per horse-power per hour.

Fig. 2 is a set of diagrams, taken during the present daily working of the engines. The medium line, *b*, has an average pressure of 15·7 lbs., and gives 202 indicated power for both engines, the engines now

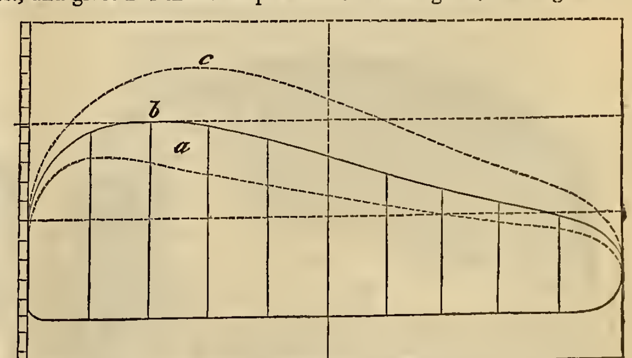


Fig. 2.

making 20 revolutions per minute; and they are doing this work with $2\frac{1}{2}$ lbs. of coal per horse-power per hour—a sufficiently small consumption, but which, we have no doubt, will be still further reduced when the felting-up is perfect.

The engines being rather light in some of their parts, the steam is let on very cautiously, as will be seen from the rounded induction corner of the diagram; but the good effect of this is felt in the absence of any jolt or concussion in the engines. Although they are subject to the very fluctuating work of a rolling mill, their speed scarcely varies, so admirably does the improved throttle-valve perform its functions.

GODDARD'S GAS COOKING-APPARATUS.

In our previous number we noticed Mr. Goddard's Asbestos Stoves, and we have now the pleasure of laying before our readers the plans of his cooking-stoves, which are of still greater importance. Nothing will do so much to improve the comfort of the Artizan's cottage as the introduction of gas for cooking. Instead of being obliged to make up a large coal fire for cooking, which renders the room uncomfortably hot, and, by the dirt and dust which it creates, involves some labour before the room can be "put to rights," the proprietor of a gas cooking-stove has merely to turn on the gas at the moment it is wanted, and when the culinary operation is completed, the gas is turned off, and there is an end of it.

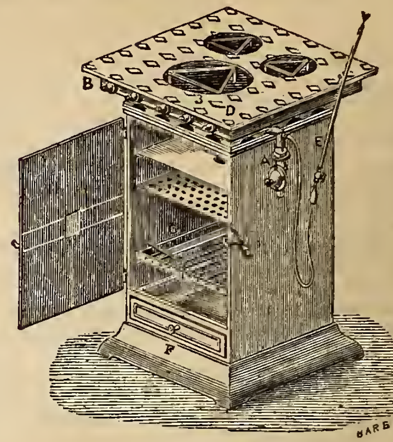
The impression that the gas must communicate some disagreeable flavour to the meat cooked over it is removed at the first trial, whilst the equable temperature, impossible to be attained with any ordinary fire, cooks the meal with less waste, and effects a saving in the dripping, which more than counterbalances the extra cost of the gas. In a case where a school has to be cooked for, the Principal says, "without it, it would be almost impossible for the work to be done without an additional servant,"—a result which is the first to strike an observer.

In the early attempts at gas cooking-stoves, considerable loss of heat was sustained by the radiation from the sides of the stove. This is very neatly obviated in Mr. Goddard's stoves, by lining the roasting compartments with glazed porcelain plates, which radiate the heat into the interior of the oven, and also prevent any effluvia which might arise if the fat were dropped on the heated iron. The burners are also of a peculiar form, which prevents the holes being choked by the fat.

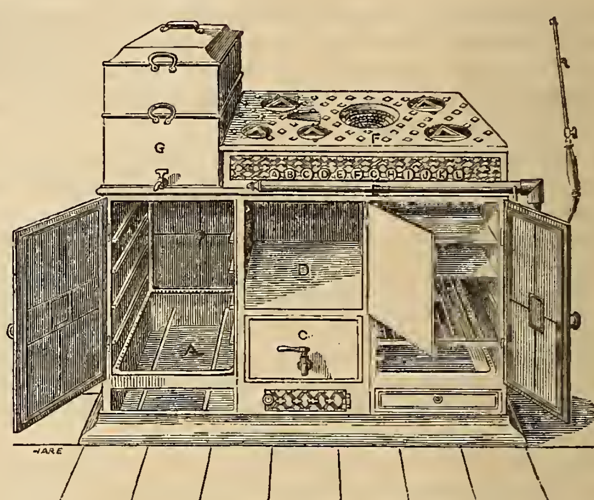
If the London gas companies would only take a hint from Ipswich, and put up gas fittings at a rental, they would not only immensely increase their sale of gas, but would make a fair profit on the manufacture of the fittings.

We will now proceed to describe these stoves.

Nos. 1 and 2 differ only in size. A is the supply pipe for gas. B, a series of Carter's screw valves, which are numbered to correspond to the burners to which they belong. C, a compartment or oven, having a burner all round the lower circumference; this is fitted with shifting shelves and a gridiron, and serves for roasting, baking or broiling. The top, D, forms a hot plate, and has three coil-burners, over which saucepans can be placed, when required. E is the gas-torch, which consists of a flexible tube with a minute burner at the end, which serves to light the various burners. F is a small door at the base, for the removal of the dripping-pan, which is peculiarly favoured by having a small burner under it, by which that pudding to which we have so often done justice when in Yorkshire, is "done brown."



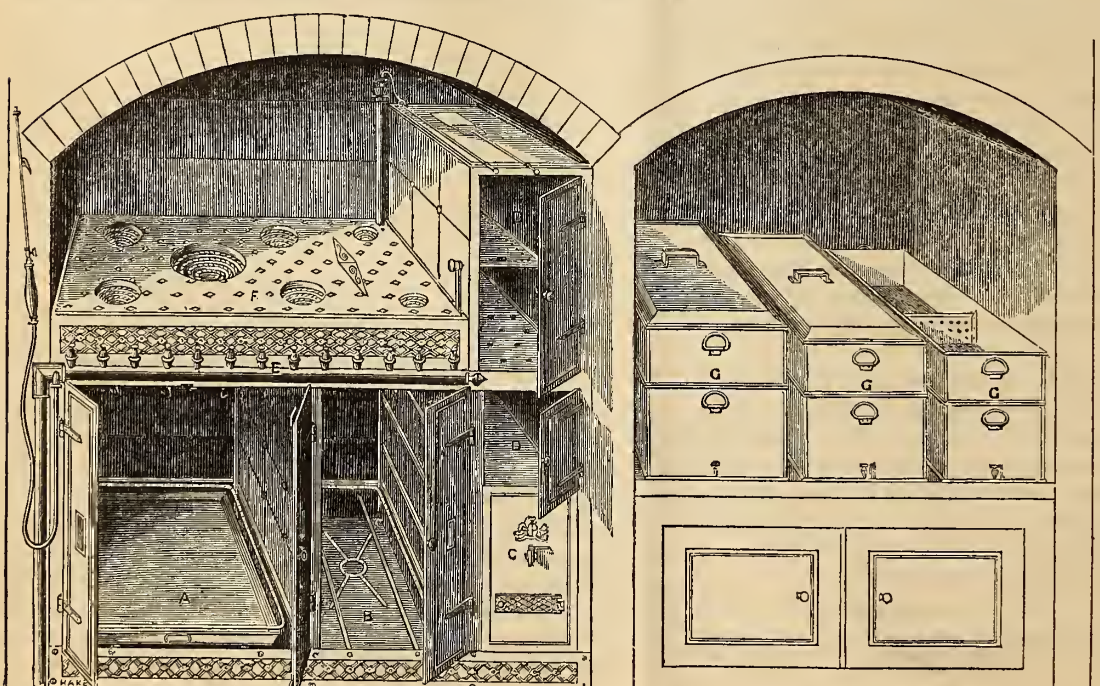
Nos. 1 and 2.



No. 3.

No. 3 is a larger apparatus. A is the roasting compartment. B a similar one for baking, &c. C a copper boiler, holding nine gallons of water, and supplying steam for the steamer G. D a hot closet, using up the waste heat from the burners of A, B, and C. It can be used for baking bread, keeping dishes hot, &c. E the supply-pipe. F the hot-plate, furnished with coil-burners. G a large vessel for steaming.

No. 4 is an apparatus of the largest kind, adapted to cook for 100 persons at a time, and suited for large schools, hotels, &c. The same letters of reference apply as in No. 3.



No. 4.

PORTABLE STEAM-ENGINE AND BOILER,

AS CONSTRUCTED BY M. RENNES, ENGINEER, PARIS.

THE numerous uses to which steam is now every day applied, has induced many attempts to simplify and cheapen the construction for small powers. Many arrangements are admissible on the small scale which it would be bad economy to attempt on the large; and perhaps this fact has been pushed to the farthest possible extent in the example before us, which we find in that very excellent journal, *Le Génie Industriel.*

Fig. 1 is an elevation and fig. 2 a section, of the engine and boiler, one-tenth the full size. The boiler, E, is of cast-iron, which will stand much better than many of our readers would suppose. Messrs. Hall, of Dartford, for many years made cast-iron boilers on the "elephant" plan;* and by making them of small diameter and ample surface, they performed very satisfactorily. In those days the manufacture of boiler plate had not reached its present state of perfection, and engineers preferred using *good* cast-iron, cast under their own eyes, to wrought-iron of which they had no experience.

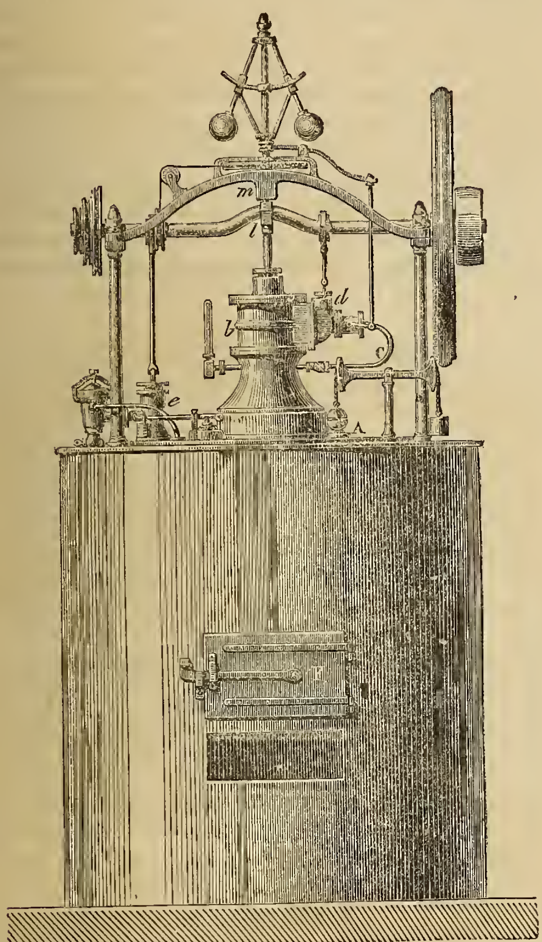


Fig. 1.

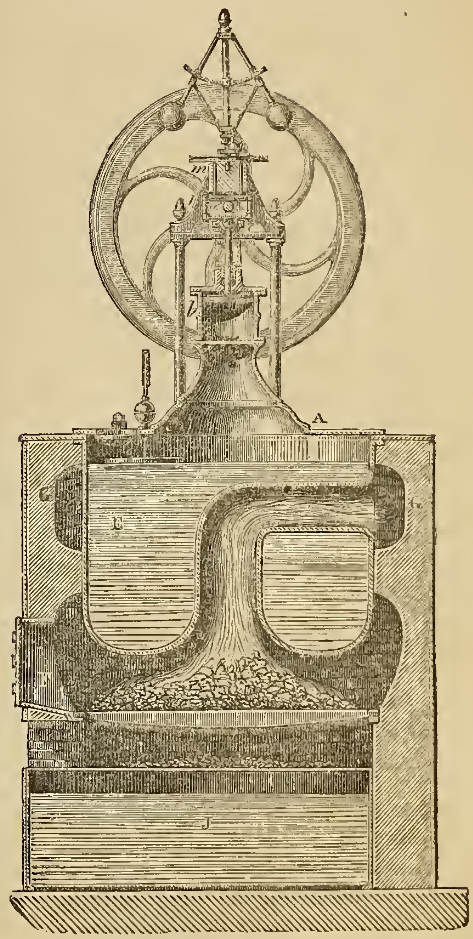


Fig. 2.

The boiler is set in brickwork, G, which is protected by a cast-iron casing, the combined weight of which renders any other foundation unnecessary. The flame enters a short tube in the boiler, and after circulating round it, escapes into the chimney. The cover of the boiler consists of a plate, A, on which is cast the base of the cylinder, *b*, from which the steam is taken directly by the pipe, C, to the slide-valve, *d*. The feed-pump, *e*, worked by an eccentric on the crank-shaft, is cast on the plate, A, to which are also attached the safety-valve, float-gear, safety-whistle, &c. J is a tank for containing a supply of feed-water. Motion is communicated to the crank-shaft from the cross-head, *l*, in which is a slot, along which the crank-pin travels; but we do not observe that the maker has provided any efficient means of counteracting the friction, which would quickly wear away the crank-pin. At page 250, *Artizan* 1850, we have enlarged upon this point, in describing Mr. Carrett's steam-pump, in which the stroke is controlled on the same principle as in the engine before us. A small oscillating cylinder, with the slide in one of the trunnions, would, we think, have been very superior to the arrangement before us, and cost little, if any, more.

This engine appears to have been designed for small workshops, for which, from its cheapness and portability, it appears well adapted; and it is claimed, as an advantage, that in winter the heat radiated from the boiler will be useful in warming the apartment in which it is placed. Only those who know the hardships suffered by the working classes in France during the winter, owing to the high price of fuel, can properly appreciate this recommendation.

* See *Artizan* 1851, p. 260.

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS,

28th July, 1852,

JOSEPH WHITWORTH, Esq., in the chair.

A PAPER by Mr. G. H. Bovill, of London, was read on Griffiths' Patent Screw Propeller.

(Continued from page 178.)

A model, illustrating the principle of the new propeller, was exhibited by the secretary (Mr. Bovill having been prevented from attending the meeting). The model showed an ordinary screw propeller, which was

divided into three portions, so that one-third of the propeller in the centre could be removed, and a ball of the same diameter substituted, upon which the two blades forming the remainder of the propeller were then fixed, in the same relative position as in the original propeller.

Mr. Preston said, he had witnessed the experiments made on the *Weaver* that were described in the paper, and could confirm the statement made as to the superiority of the new propeller in the diminution of slip, and the increase of speed of the vessel. He did not perceive any superiority in the amount of backwater produced; in going ahead, the vessel dipped astern with both propellers, and he did not perceive any difference; but it was a very flat vessel, and the bows rose so abruptly, that the head was forced up by the action of the water. The experiments were tried in the Mersey, above Liverpool, and the effect of tide was deducted by trying the experiment both ways. He doubted the practicability of keeping the apparatus for altering the pitch in working order, at sea, for any length of time.

Mr. Ramsbottom remarked, that if the pitch of the blades in an ordinary screw propeller were the same throughout down to the centre boss, every part of the blade would have the same advancing motion in the water, and would screw correctly through it; and he could not understand how the centre portion of the blades could have the injurious flapping and centrifugal action mentioned in the paper, when the screw was advancing through the water, as such action could only take place if the arms were to revolve whilst the vessel was stationary.

Mr. Appold observed, that the ball would deflect the water, and throw a body of water on to the blades, giving them more water to act upon, and preventing the water from slipping away from the pressure of the blades through the centre of the propeller, as in the ordinary form with an open centre. Supposing the propeller were working through a tube of the same diameter as the circumference of the arms, the centre ball would occupy one-third of the diameter of the tube, and reduce its effective diameter, causing all the water to pass through the reduced area, and so bringing more water in contact with the arms in the same distance, and affording them a more solid abutment for their action.

Mr. B. Gibbons thought it was to be inferred from that argument, that it would be advantageous to enlarge the shaft to the size of the ball, so as to fill up the displacement of the ball, and that would avoid the resistance offered by the front of the ball being dragged through the water.

Mr. Appold suggested that a conical form might be preferable for the front of the ball, to deflect the water from the centre on to the arms. He had found that best in his centrifugal pump, in which there was a similar action, and the water entering at the centre had to be suddenly deflected at right angles into a radial direction; he had tried a pump with the centre bell-mouthed from the inside, with the object of affording a more free entrance for the water, but he found it gave less results than the form he had adopted, having a square edge inside the opening, and the centre coned from the spindle to the centre disc.

The chairman observed, that further experiments with the new propeller were very desirable; and he proposed a vote of thanks to Mr. Bovill for his paper, with a request that he would furnish to the Institution the results of further trials of the propeller, which was passed.

The following paper, by Mr. W. Keld Whytehead, C.E., of London, was then read:—

ON A NEW DIRECT-ACTING STEAM-PUMP.

This steam-pump is of American invention, and has been used extensively there for feeding the boilers of marine engines. It is, however, well adapted for any purpose where a moderate quantity of water has to be raised, and where a rotary motion is not required. One is fixed at the Great Northern station, at King's Cross, London, and used for supplying the station with water.

Its chief peculiarity is that the stroke of the piston and of the pump plunger is regulated without the use of a crank, so that the motion of the plunger is nearly uniform for the whole length of the stroke. Mr. Ericsson (of Messrs. Braithwaite's firm) made a fire-engine on this principle some years back, and Mr. Penn formerly used the same arrangement for "donkey engines" for steamboats; but both of these kinds of engine were deficient in smoothness of working—a difficulty which has been overcome by Messrs. Worthington and Baker, the patentees of the present pump, by very simple and effectual means. Drawings and details of this pump will be found at p. 121.

This pump has been at work for five months at King's Cross station very satisfactorily, the only repairs necessary having been about one day's work. It has to draw the water 14 feet perpendicular, and forces it 30 feet perpendicular. The usual speed is 40 to 50 double strokes per minute, but there is no difficulty in working it double that speed if desired. The uniformity of the stream of water delivered is very remarkable, and seems to indicate that there is no loss of power, or, to speak more correctly, that there is never an excess of power to impart an undue velocity to the water. The small space occupied by the pump is an advantage of some importance when used for marine purposes.

Mr. Ramsbottom observed that he had seen the pump at work at the King's Cross station, and it certainly worked well, with very little vibration, and delivered a steady uniform stream of water; but it was a defect that the economy of working expansively could not be obtained with a pump on that principle, as the full pressure of steam was required to complete the stroke. There was a simple contrivance in the shut-off valve of the delivery pipe, for changing the direction of the discharge; the valve was constructed with a double face, and fitted to shut the opening on either side, so as to pump into the tank, or into the fire-hose, by screwing the valve spindle in one direction or the other.

The secretary said that Mr. Whytehead had expected to have given the results of a trial of the pump to ascertain the duty yielded by it, by measuring the quantity of water discharged, and taking indicator figures from the engine; but he had not yet been able to make the experiments.

Mr. Preston remarked, that a direct-acting steam pump had been constructed by Mr. Penn, for feeding marine boilers, but that he adopted a crank motion now for the purpose, finding the vibration and shock of the tappet motion too great for working the valve.

Mr. Ramsbottom observed that the steam buffer spring upon the valve spindle in this pump appeared to be very effectual in taking off the shock, even when working at a considerable speed; and the equilibrium established between the two ends of the pump, by means of the holes through the plunger, caused the valves to close down upon their seats almost before the return stroke, and prepare the pump for the reversed action of the steam.

Mr. Middleton thought there would not be any advantage gained with this pump in simplicity over a crank engine, and it would not be so economical in power, from not being able to work the steam expansively.

Mr. Appold inquired how long the India-rubber valves were found to last in pumps.

Mr. Preston said, the India-rubber valves answered very well in the air-pumps of marine engines; they were always used for screw vessels, on account of the rapid action of the valves with short-stroke engines, for which metal valves were not applicable. The time they lasted varied very much with the circumstances; vulcanised sheet India-

rubber only should be used, and might last some months, perhaps a year, but the canvas valves coated with India-rubber soon decayed.

Mr. Clift remarked that a new mode had been brought out of preparing India-rubber with sulphuret of lead, instead of vulcanising it with sulphur, which was said to be better and more durable; but he did not know the results of trial.

Mr. Appold doubted whether vulcanised India-rubber would stand a constant elastic action for a year, or even a less period. He had tried some India-rubber springs for window-shutters, and found they failed in three or four months; it was some years back, and he did not know whether the process of manufacture had been improved since.

Mr. B. Gibbons said, he had found the elastic bands for papers, after lying by for two or three years, lost their elasticity, and became decayed.

Mr. Adams inquired whether the vulcanised India-rubber rings in railway carriage buffers and draw-springs were found to decay.

Mr. H. Wright said, he had found the rings in buffers still remaining good after three or four years' work; the India-rubber was subjected to compression only, and was protected from wet. He had several hundred waggons under his charge working with India-rubber buffers and draw-springs, which were all doing very well; the only failure of the India-rubber rings that had been experienced amongst them was from the intermediate plates or washers between the rings, which were made at first of cast-iron, and too thin, becoming broken, and then cutting the India-rubber; but that had been remedied by using stronger wrought-iron washers.

Mr. S. Lloyd observed, that the India-rubber buffers had also been several years in extensive use on the Great Western Railway for all their carriages, and, he believed, with satisfactory results.

Mr. Clift remarked, that it had been explained by the maker, Mr. De Bergue, at a former meeting of the Institution, that there was some imperfection in the vulcanised India-rubber first manufactured, which made it less durable; but the defect was removed in all the subsequent manufacture.

Mr. Preston observed, that the India-rubber in pump-valves was subjected to more severe wear, from the constant rapid bending and the action of the water, than the mere compression in buffer springs. Some of the valves proved defective at first, in consequence of being cut transversely from a cylinder of India-rubber, which was manufactured by rolling up a long sheet; these valves split open in the roll and became defective, from the constant action upon them; but all he now used were cut out of a single flat sheet, and were found to stand very well.

The chairman proposed a vote of thanks to Mr. Whytehead, for his description of the pump, which was passed, and expressed a hope that he would furnish at another meeting the results of a trial of the duty yielded by the pump.

The following paper, by Mr. John E. Clift, of Birmingham, was then read:—

ON IMPROVED FIRE-BRICK GAS RETORTS.

The object of this paper is to describe a plan for constructing gas retorts, which the writer has had in use several years at the works under his management, and has also adopted at various other towns; and the only apology he has to offer for bringing it before the meeting is, the request of the council of the Institution to furnish the practical results of the working of the plan.

The first great desideratum in a gas-generating retort is, on all hands, acknowledged to be *surface*—a large surface—upon which may be spread a thin layer of coal; this was early shown by Mr. Clegg, in his invention of the revolving-web retort, the only difficulty in working which was the destructible nature of the material of which it was composed.

The second condition required is, that this large surface shall be *economically heated*. A strong opinion existed for a long time against the use of fire-clay for retorts, in consequence of the inferior heat-conducting properties of that material compared with iron; but experience has proved that as large a quantity of gas can be generated, with a given weight of fuel, with fire-clay retorts as with iron. This may be accounted for partly by the fire-clay losing less of its heat on being exposed to the air whilst charging, and on the cold charge of coal being first thrown in; or, in other words, that the greater mass of fire-clay acts as a reservoir of heat, and does not become so readily exhausted when a large demand is made upon it, but, on the contrary, maintains a greater uniformity of temperature throughout the process. This is easily demonstrated by observing the small quantity of gas made from an iron retort during the first hour after charging, compared with a fire-clay one. It is also partly accounted for by the iron retorts, as they are generally set, being so covered and shielded with fire-bricks, to preserve them from destruction, as to partake as much of the character of clay retorts as of iron.

The following table, which is the average of a number of experiments, gives the quantities of gas generated, as indicated by the meter, from iron and clay retorts, during each half-hour of the charge, from the same quantity and quality of coal:—

Iron Retorts.			Brick Retorts.		
1 half-hour	250	cubic feet	1 half-hour	480	cubic feet.
2 „	630	„	2 „	1,800	„
3 „	1,340	„	3 „	2,000	„
4 „	2,300	„	4 „	2,000	„
5 „	2,600	„	5 „	2,300	„
6 „	2,640	„	6 „	2,300	„
7 „	2,600	„	7 „	2,460	„
8 „	2,600	„	8 „	2,400	„
9 „	1,700	„	9 „	2,000	„
10 „	1,630	„	10 „	1,630	„
11 „	1,790	„	11 „	860	„
12 „	700	„	12 „	550	„
Total	20,780		Total	20,780	

The third requisite in a retort is *durability*. The proper way to measure this element is to divide the quantity of gas made by the cost of the retorts and ovens, and the repairs during the time they are worked. This will be shown presently by a comparison from the actual working of iron and clay retorts.

The retorts to be described in the present paper are composed entirely of fire-bricks, with cast-iron front plates to attach the mouth-pieces to, and to bind the brickwork together; and they are made of any length, width, or height. They are generally constructed in sets of three, as shown in fig. 1, which is a front elevation.* A A are the front plates of cast-iron, $1\frac{1}{8}$ inch thick. B B are the wrought-iron stays, $4 \times 1\frac{1}{2}$ inches, fastened at the bottom by cramps built into the brickwork, and at the top by tension bars, connected to similar stays on the opposite side. C is the furnace door. D D, two retort mouth-pieces, 15×15 inches. E, a large retort mouth-piece. F, sight-holes for examining the flues and cleaning dust from the external surface of the retorts.

Fig. 2 is a transverse section. G is the furnace; H H are the two lower retorts, 15 inches wide, 15 inches high, and 20 feet long, with a mouth-piece at each end. The fire-bricks forming the bottoms and sides of the retort are 16 inches long and 3 inches thick, and the arch

* We are indebted to the courtesy of the Editor of the "Journal of Gaslighting" for these very excellent illustrations.

bricks forming the top are 9 inches long by 3½ inches deep. Each brick is rebated 1 inch deep in the transverse joints, and grooved in the longitudinal joints, as shown by the enlarged drawing, fig. 3; these grooves are filled with stiff fire-clay when they are put together, which burns into a hard tongue half an inch thick, as it becomes heated; the object of these tongues is twofold—they offer a resistance to the leakage of the gas by breaking the joint, and they tie together the arch of the retort.

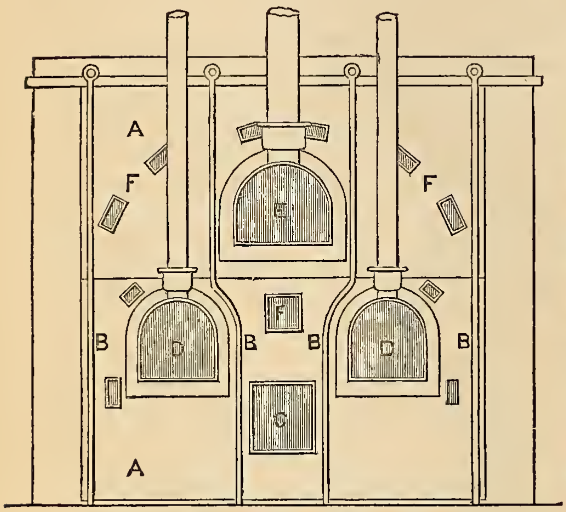


Fig. 1. Front Elevation. Scale 1-40th real size.

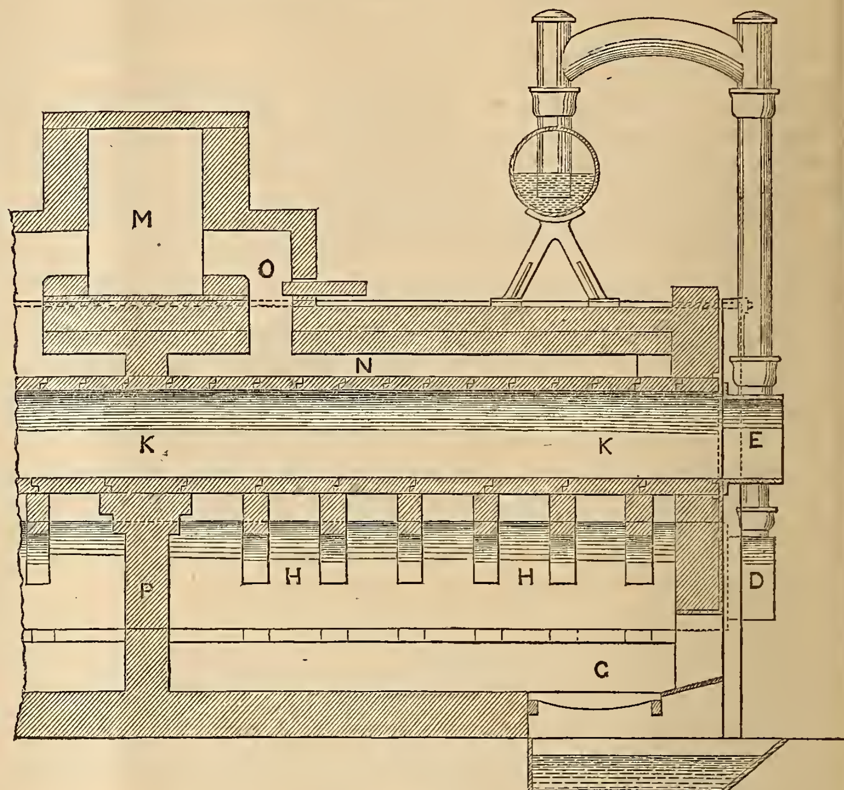


Fig. 5. Longitudinal Section.

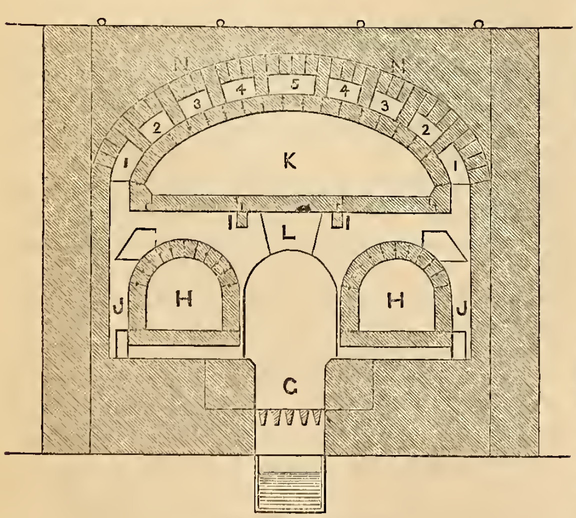


Fig. 2. Transverse Section.

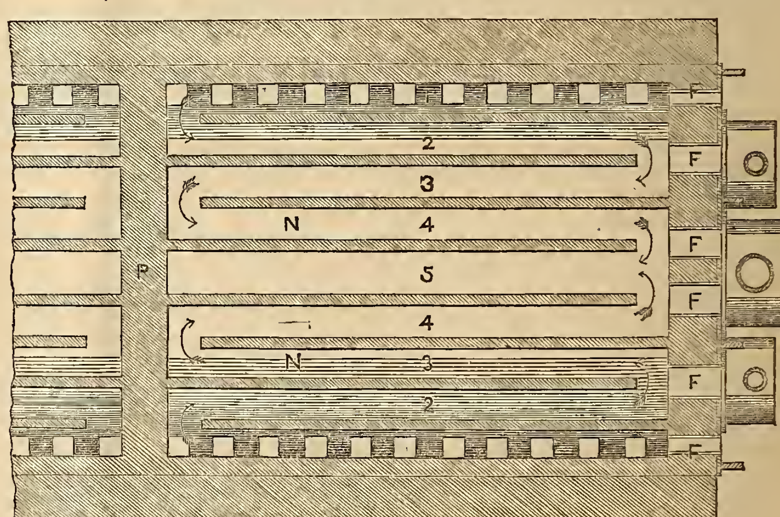


Fig. 4. Plan at Top of Upper Retort.

K is the large upper retort, 5 feet 3 inches wide and 20 feet long, open for charging at both ends; the bricks are similar to those forming the small lower retorts. L is a cross arch, 5 inches thick, spanning the furnace flat on the top, which covers the under side of the transverse joints of the bottom of the large retort; the longitudinal joints are covered by small arched bricks, marked I. J are the side flues, and N the longitudinal flues, shown more fully in fig. 4, which is a plan of the top of the upper retort, showing the course of these flues. In rising from the furnace, the heat passes partly underneath and partly over the small retorts into the first flue, No. 1, moving to the back of the oven, then crosses the division, and returns to the front along the second flue, then to the back along the third flue, and to the front along the fourth, when it meets with the heat which has gone through a similar course on the opposite side, and passes along the middle flue, No. 5, into the main flue, M, as shown in the longitudinal section, fig. 5. By this arrangement the heat passes over 50 feet length of surface of

retort from the time it leaves the furnace until it reaches the main flue.

Fig. 5 is a longitudinal section through the upper retort K, showing the opening into the main flue, M, and the damper, O, by which the draught is regulated. In this figure, the position of the cross arches, L, that carry the large retort, is shown, covering the joints in the bottom of the retort; also the centre wall, P, which divides the two furnaces and flues, and carries the main flue.

Fig. 6 is a plan of the lower retorts, showing the two furnaces, G G, with the centre division-wall, P, the side flues, I I, and the floor of the lower retorts, H H.

It will be seen, by the plans figs. 4 and 6, that the sight-holes, F F, are so arranged as to command a view of the whole longitudinal and side flues, by which means the condition of the retorts may at all times be observed, and any defects detected.

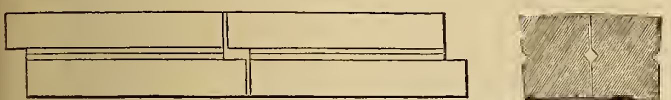


Fig. 3. Details of Arch Bricks. Scale 1½ inch to a foot.

state, and the expansion from the moisture is great, the screws of the tension rods may be eased, which will allow the whole mass of brickwork to swell; but as soon as the moisture is expelled, it will sink back into its place, and be as perfect as when first built. When a set of these retorts is first put to work, either new or after being let down for any purpose, it leaks through the joints for about twenty-four hours, gradually stopping; and after that time, if the heat be good, it will have become quite sound, and permanently gas-tight, under a pressure equal to 10 or 12 inches head of water.

From a sufficiently long experience, the writer has proved that brick retorts built upon this plan will wear for ten years, with the outlay of twenty shillings per annum for repairs, and that iron retorts will not last more than a year and a half, under the most favourable circumstances. Then, to show their comparative economy, take a number, say twenty sets or beds of iron retorts, and twenty beds of brick retorts, each bed being capable of making 20,000 cubic feet of gas in twenty-four hours; and to make the calculations as correct as possible, let the cost and repairs of each be estimated, and the quantity of gas they will make, during a period of ten years, in order to ascertain the cost of the gas produced from each plan per 10,000 cubic feet.

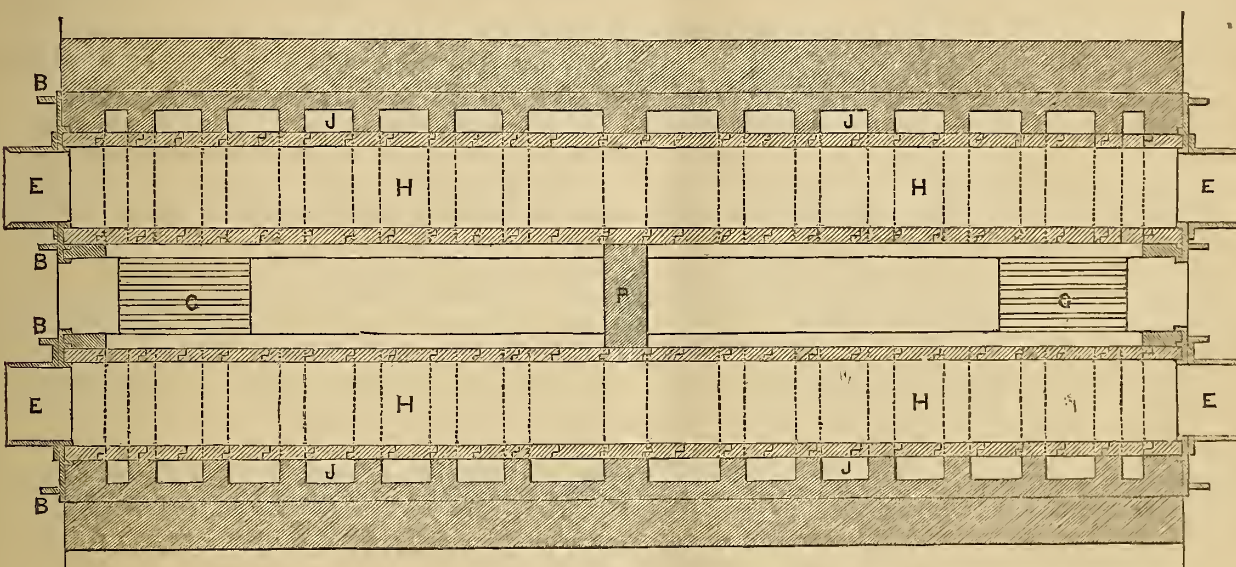


Fig. 6. Plan at Centre of Lower Retorts.

With regard to the durability, the writer may observe, that twelve sets of these retorts were put up by him in 1842, and worked constantly, with the exception of short periods, up to 1849, when they were taken down for the alteration of the works, and they were found then in good condition, and were fit for working several years longer with slight repairs. The writer also put up twelve sets of these retorts in 1844, and they continue in regular work now, and are in good condition; the cost of repairs of the retorts, ovens, and furnaces during the eight years they have worked has not exceeded twenty shillings per annum for each set.

The writer accounts for the durability and economy of retorts constructed on this plan, firstly, by their being composed of a great number of pieces, instead of only one; so that when their temperature is altered, either by the carelessness of the stokers, or in letting down the heat to throw the retort out of work, each joint opens a little, equal to the contraction of a 9-inch brick, and prevents any portion of the retort cracking. In the same way, in getting up the heat (which is a time when a great number of clay retorts made in one piece are destroyed), if one portion of the retort becomes heated more than another, the joints accommodate the expansion; or, if the brickwork is in a very green

First cost of 20 beds of iron retorts:—			
Bricks, clay, and labour for arches ..			£367 0 0
100 cast-iron retorts, 18 cwt. each, 90 tons, at £6			540 0 0
Fire bricks, shields, quarries, &c., for setting			150 0 0
Labour for setting, 60s. each			60 0 0
Cost of renewing 20 beds of iron retorts:—			
100 iron retorts, 90 tons, at £6		£540 0 0	
Bricks and clay		150 0 0	
Labour, taking down and resetting ..		80 0 0	
		£770 0 0	
Less by old burnt iron, 50 tons, at 25s.	£62 10 0		
Less by one-third of bricks, which may be used again..	50 0 0	112 10 0	
		£657 10 0	
This sum will be multiplied by 6½, the number of times they will be renewed in 10 years, which will give			4,270 10 0
Making the total expense of iron retorts ..			£5,387 10 0

First cost of 20 beds of brick retorts :—			
Bricks, clay, and labour for arches.. ..		£367 0 0	
Iron for front plates and brick-stays, 21 tons, at £6		126 0 0	
Pattern and other bricks and clay for retorts		180 0 0	
Labour for building retorts..		110 0 0	
		£783 0 0	
Cost of repairs for 10 years, at 20*s.* per bed per annum..	£100 0 0		
Less value of old front plates, &c,, 20 tons, at 25*s.*	25 0 0		
		75 0 0	
Making the total expense of brick retorts..		£858 0 0	

Now, as the quantity of gas that each of the two descriptions of retorts is estimated to generate is the same for ten years, namely, 1460 millions cubic feet, it follows that the gas from the cast-iron retorts costs 9*d.* per 10,000 cubic feet, and that from the fire-brick retorts $1\frac{1}{3}$*d.* per 10,000 cubic feet, for the item of retorts and ovens; showing an economy of 84 per cent. in the improved fire-brick retorts.

Mr. Clift exhibited specimens of the fire-bricks, showing the mode of jointing them, to prevent leakage of the gas.

Mr. Chellingworth inquired whether a defect in a brick retort could be repaired, such as a bad joint? When an iron retort became broken it could not be repaired, and all was lost, and had to be pulled out, but it was a great advantage in the brick retorts if they could be readily repaired.

Mr. Clift replied that a defect could be easily repaired at any time, without stopping the working of the retorts; the surface of the retorts could be thoroughly examined through the different sight holes, and any defective joint detected by the appearance of a gas flame; and a single brick could be taken out of any part when required, and removed by proper tools through the sight holes, which were made large enough for a brick to pass, and another brick was then set in its place with fire-clay, without occasion to let down the heat of the retort. When a brick retort was pulled down, it was found that the carbon deposited from the gas filled up any crack or fracture, by the carbon adhering to the rough surface of the brick and collecting upon it, from the indestructible nature of the brick. But a crack in a cast-iron retort continued getting worse, and became constantly more open, on account of the surface of the iron perishing in the sides of the crack, which prevented it from getting closed up by a deposit of carbon, as in the brick retorts. When a cast-iron retort was once cracked it was done for, and must be thrown away, requiring the whole oven to be opened out and rebuilt, and causing a serious delay to the work, as well as expense.

Mr. Ramsbottom remarked that the greater equality in the rate of expansion by heat of carbon and fire-brick, than of carbon and cast-iron, would probably assist in keeping the joints close.

Mr. Clift observed, that on pulling down the brick retorts, after seven years' working, it was found that the joints were completely blackened and filled with carbon half way through, up to the fire-clay stopping in the centre groove; but the outer half of the joints showed no appearance of the carbon having passed the groove.

Mr. H. Wright said he had lately had some gas-ovens built on Mr. Clift's plan, instead of renewing the cast-iron retorts used previously, and they had been at work for some months very satisfactorily; there was no appearance of defect in getting up the heat or letting it down; and he considered that the plan was an important improvement.

Mr. Clift observed, that the plan of constructing the retorts of double the usual length, with a mouth-piece at each end, he had only had in use for about a year, but he found it a decided improvement, and had since adopted it in all new works. The other retorts became scurfed up with a large accumulation of carbon, particularly at the back ends, where the scurf became several inches thick, and very hard, and the retorts had to be stopped work and the heat let down, usually every eight months, for the purpose of clearing out this scurf, and getting it detached by the contraction in cooling. But in the long retorts, open at both ends, there was no back for the scurf to accumulate against, and the current of air through the retort every time that both ends were opened caused the scurf to scale off, and it was much easier to detach, and consequently it was found that they would work much longer before requiring to be let down. Also the centre portion of the oven, which is the hottest part, and most valuable for making gas, was lost before by the blank ends of the retorts, but is now made available, as there is only a single brick wall dividing the flues, and by this means the heating surface and contents of the retorts are increased, without any increase in the size or expense. Another advantage is found in preventing the injury and shaking of the joints that was caused in drawing the coke from the retort, by the heavy rake being driven against the back of the retort.

The thanks of the meeting were voted to Mr. Clift for his paper, and the meeting then terminated.

After the meeting, a model was exhibited of a new construction of permanent way for railways, by Mr. J. E. M'Connell, of Wolverton.

ON THE CONSTRUCTION OF STEAM BOILERS,

BY W. FAIRBAIRN, ENGINEER, MANCHESTER.

In the *Artizan* for 1851, p. 129, will be found an abstract of two lectures on "Steam-boilers and the Causes of their Explosion," delivered by Mr. Fairbairn, at Leeds. We have now before us a report from the *Manchester Guardian* of 18th inst., of a paper on the same subject, read by Mr. Fairbairn before the British Association at Belfast, on which we propose to offer a few remarks.

Mr. Fairbairn was, we believe, the introducer into Manchester of the cylindrical boiler, with two internal cylindrical furnaces, which, in April, 1851, he describes as "the simplest, and, probably, the most effective that has yet been constructed." Further experience has induced Mr. Fairbairn to modify his views, as will be seen from the following extracts from the *Guardian* :—

"Every description of boiler used in manufactories, or on board of steamers, should, in my opinion, be constructed to a bursting pressure of 400 lbs. to 500 lbs. on the square inch; and locomotive engine boilers, which are subjected to a much severer duty, to a bursting pressure of 600lbs. to 700lbs. It now only remains for me to state that internal flues, such as contain the furnace in the interior of the boiler, should be kept as near as possible to the cylindrical form; and as wrought iron will yield to a force tending to crush it of about one-half of what would tear it asunder, the flues should in no case exceed one-half the diameter of the boiler; and with the same thickness of plates they may be considered equally safe with the other parts. But the force of compression is so different to that of tension, that I should advise the diameter of the internal flues to be in the ratio of 1 to $2\frac{1}{2}$, instead of 1 to 2, of the diameter of the boiler.

"To construct boilers as nearly as possible of maximum strength, I have already observed, they should be of the cylindrical form; and where flat ends are used they should be composed of plates one-half thicker than those which form the circumference. The flues, if two in number, to be of the same thickness as the exterior shell; and the flat ends to be carefully stayed with gussets of triangular plates and angle-iron, firmly connecting them with the circumference. The use of gussets I earnestly recommend, as being infinitely superior to, and more certain in their action and retaining powers than, stay rods. Gussets, when used, should be placed in lines diverging from the centre of the boiler, and made as long as the position of the flues and other circumstances in the construction will admit. They are of great value in retaining the ends in shape, and may safely be relied upon as imparting an equality of strength to every part of the structure."

"Since the delivery of these lectures (says the *Guardian*), considerable progress has been made in the construction of tubular boilers in the Lancashire districts, in which Messrs. Gordon, of Stockport, and some others, have taken a prominent part. In these constructions sufficient attention has not, however, been paid to form and a judicious distribution of the material, so as to ensure the section of greatest strength. It has already been noticed, that the cylinder is the only form in which metallic plates can be arranged for resistance to uniform and equable pressure; but in boilers this cannot always be effected in practice, so as to render these vessels in any case convenient and calculated to meet the varied requirements essential in these constructions. The engineer has frequently to deviate from what is known to be the strongest form and to work out, under what otherwise may be considered defective construction, the elements of uniform strength; this is not, however, always accomplished, as no inconsiderable number of engineers and boiler-makers, either from ignorance or neglect, are not aware of the importance of a knowledge of these facts.

"Large flat surfaces, such as the ends of cylindrical boilers, the fire-boxes of locomotive engines, and nearly the whole of marine boilers, are of this description; and it requires considerable care in the construction, as well as a knowledge of the nature of the strains, to ensure uniformity of resistance in all the parts, to uniformity of pressure. In every case where flat surfaces are exposed to pressure from such a dangerous element as steam, it is absolutely imperative that those flat surfaces should be made equal in their powers of resistance to the other parts, otherwise a superfluous quantity of material is used, which, by retarding the transmission of heat, prevents that rapid conduction, which is the object to be attained in a well-constructed boiler. In fact, the true nature of these constructions should be uniform resistance and simultaneous action; so that, in the event of extreme pressure, every part of the structure should be on the point of yielding at one and the same time. But on these points we must refer to the recommendation and methods adopted in the construction of the improved tubular boiler, of which we present our readers with a diagram, and the descriptions, as given by Mr. Fairbairn to the mechanical section of the British Association at Belfast."

We have not engraved the drawing in question, because an accurate idea of its arrangement will be obtained by referring to the engraving of Messrs. Galloway's patent boilers, at p. 101, *Artizan* 1850. In the union of the two furnaces behind the bridge, and the use of conical water-tubes to support the elliptical portion of the flue, Mr. Fairbairn has been anticipated by Messrs. Galloway, the only difference being, that Mr. Fairbairn carries the draft finally through small tubes, instead of around a further number of water-tubes. Boilers of almost identically the form recommended by Mr. Fairbairn have been used for some years as marine boilers; and although their lightness, from the small quantity of water which they contain, is a recommendation for marine purposes, it appears to us that the small fire-tubes are inferior for land purposes to Messrs. Galloway's conical water-tubes, the latter not being liable to be choked with deposit from the coal, and offering infinitely greater facility for clearing out the deposit from the water.

Mr. Fairbairn, in speaking of the tubular structure, states, "It is now upwards of fourteen or fifteen years since I first introduced the cylindrical boiler with double flues and double furnaces, which, up to the present time, has been successful and in general use. Repeated attempts have been made to improve this construction; but it has yet to be proved whether the alterations recently introduced are substantially improvements on the original boiler, with the double furnaces and alternate firing. The new boiler, as now constructing by Messrs. William Fairbairn and Sons, consists of two furnaces, the same as the double flue boiler, but with this difference, that the cylindrical flues, each 2 feet 8 inches diameter, which contain the grate bars, are united, 8 feet from the front of the boiler, into a circular flue, 3 feet 10 inches in diameter, which forms the mixing chamber, and where the heated currents of combustion from each furnace unite. This chamber, 8 feet long, terminates in a disc plate, which, with a similar plate at the extreme end of the boiler, receives from 104 to 110 3-inch tubes, also 8 feet long, similar in every respect to the tubes used in marine boilers and the locomotive. These tubes are contained in a boiler 7 feet in diameter, and from the thinness of the metal becomes the absorbents of the surplus heat escaping from the mixing chamber and the furnaces. On this principle of rapid conduction, the whole of the heat, excepting only what is necessary to maintain the draught, is transmitted into the boiler; and hence follows the economy of entirely dispensing with brickwork and flues, an important desideratum in those constructions.

"The heating surfaces in the improved boiler, as compared with the old one, are as follows:—

NEW TUBULAR BOILER.

	Feet.
Heating surfaces in two furnaces	128
Do. do. in mixing chamber	80
Do. do. in vertical tubes	28
Do. do. in 104 3-inch tubes	670
Total	906

OLD DOUBLE FLUE BOILER.

Heating surfaces in two furnaces	110
Do. do. in two internal flues	270
Do. do. exterior surface in brick flues	240
Total	620

which gives a ratio in favour of the improved boiler of about 6 to 9.

"In the construction of the improved boiler just described, it must be observed that in 'gathering' or forming the plates as they pass from the two circular furnaces into the cylindrical chamber, an ellipse is formed, and in order to render this part of equal strength, and increase the vaporative power of the boiler, three vertical tubes, six inches diameter at the bottom and nine inches at the top, are firmly riveted through the transverse diameter of the ellipse, thus imparting the required strength to that part, which, if not attended to, would contain the elements of destruction whenever the boiler should happen to be severely pressed. The flat ends are points of construction which require equally careful attention, and there is no plan so well adapted for such a purpose as gussets radiating from the centre of the boiler, securely riveted by angle-iron to the external circumference, and by having them divided at not more than twelve inches on the circumference. The required uniformity of strength, assuming the end plates to be one-half thicker than the shell of the boiler, will be as nearly as possible obtained."

It gives us great pleasure to find so eminent an engineer as Mr. Fairbairn adopting, in 1852, the views which we urged in 1850; and we would suggest, in conclusion, that, in any future public discussion of the subject, he should repair the oversight which he appears to have inadvertently committed, of omitting to mention Messrs. Galloway's name in connection with the system of the junction furnaces and conical water-tubes.

MANUFACTURE OF STEARIC CANDLES.*

(Continued from page 199.)

DESCRIPTION OF THE LIME PROCESS, AS PRACTISED AT MESSRS. OGLEBY AND CO'S WORKS AT LAMBETH.

Saponification.—Into a large wooden vat, containing a coil of steam-pipes, pierced with small holes, ten tons of tallow are placed, with a quantity of water. The steam, when turned on, issues through the holes into the water, raises its temperature, and melts the tallow; as soon as the water has entered into brisk ebullition, a quantity of lime, in the state of thin cream, is added, and the ebullition continued for six hours, or until complete saponification is effected. From 10 to 15 parts of dry quick-lime are added for every 100 parts of tallow. The lime decomposes the tallow, and combines with the resulting stearic, margaric, and oleic acids, forming a lime soap (rock soap), and sets the oxide of glycera at liberty, in its hydrated state, as glycerin, which dis-

* Report of the Jury of the Great Exhibition.

solves in the water. The whole is allowed to cool in the vessel in which the boiling is effected, and the solution of glycerin run off.

The rock soap, when cold, is reduced to a coarse powder by a mill, consisting of a pair of fluted rollers, over which an axis is placed, carrying tiger-like claws, which revolve between a series of horizontal prongs. The claws, by passing between the prongs, tear the large lumps into small pieces, which are then crushed by the fluted rollers.

Decomposition of the Lime Soap by Acid.—The ground lime soap is now placed in lead-lined vats, supplied with a perforated copper steam-coil, each vat being capable of holding fron eight to ten tons. When the temperature has reached the boiling-point, sulphuric acid, previously diluted, is added, in the proportion of 25 parts to every 100 parts of tallow employed. The sulphuric acid combines with the lime, forming an insoluble sulphate of lime, and liberates the oily acids, which float at the top, and are then termed " yellow matter." This yellow matter is run off by cocks, placed at the proper level, into large-spouted vessels, called "jacks," and poured from these into flat tin moulds, in which it is allowed to cool and crystallise.

The sulphate of lime, after being well washed with boiling acidulated water, to remove the adhering fat, is sold as manure.

Pressing the Fatty Acids to remove the Oleic Acid.—The cakes of yellow matter are interleaved with cocoa-nut mats (without being sliced and enclosed in bags, as was formerly the case), and subjected, between iron plates, to a pressure of 600 tons, in a vertical hydraulic press. A great portion of the oleic acid is thus removed, and the mixture of stearic and margaric acids rendered much whiter.

Refining.—The cold-pressed acids are then melted by steam in a lead-lined wooden vat, with a little dilute sulphuric acid, to remove any oxide of iron, or other impurity; poured into flat tin trays, and again allowed to cool and crystallise.

Hot-pressing.—The cakes of stearic acid, when cold, are put separately into a linen bag, interleaved with cocoa-nut matting and iron plates, previously heated by steam, placed in the trough of a horizontal hydraulic press, which is likewise heated by steam, and then subjected to great pressure for some time. By this operation the remainder of the oleic aeid, holding a little of the solid acid in solution, is removed. The pressed cakes retain a small quantity of oleic acid at the edges; these are scraped off, melted, and again pressed.

Second refining.—This process is simply a repetition of the first process of refining.

Moulding.—In the manufacture of the best description of stearic candles, the moulding is generally performed by hand. The moulds are of pewter, several being fixed in a wooden frame; these moulds are heated to a temperature approaching the fusing point of the stearic acid, and are rapidly wicked, in the manner already described, in speaking of tallow mould candles.

The wicks are all previously prepared by immersion in a solution of boracic acid, or the ammoniacal salts of this and other acids, the preparation varying with the experience of different manufacturers. This preparation, called flux, serves to fuse the ashes of the wick into minute globules, which are seen on the extremity of the wick, and which are readily dispersed, and also prevents the formation of earthy and alkaline soaps.

The melted material having been allowed to congeal to a great extent, is run into the moulds. After cooling, the candles shrink sufficiently to be removed with a few light taps on the frame.

The fusing points of stearic candles are remarkably uniform, though manufactured by various makers in different countries; for example, those taken from Messrs. Ogleby's case congealed at 55·25° C. (131·5° F.), and one from De Milly's at 55·50° C. (132° F.) This coincidence is very remarkable. Stearic acid fuses at 70° C. (158° F.); margaric acid at 60° C. (140° F.); so that, from the mixture of the two, a compound is formed which fuses at a lower degree than either of the components, for it is almost impossible to assume that the solid acid should still contain a sufficient quantity of oleic acid to reduce its fusing point to such an extent.

DESCRIPTION OF THE SULPHURIC SAPONIFICATION AND DISTILLATION PROCESS EMPLOYED AT THE WORKS OF PRICE'S PATENT CANDLE COMPANY.

Sulphuric Saponification.—About 20 tons of fat, say palm-oil, are placed in a large lead-lined vat, and fused by a steam jet. The fluid mass, after being allowed to settle, has now to be exposed to the combined action of concentrated sulphuric acid and heat; and for this purpose is pumped into the acidifying vessel, in which its temperature is raised to 177° C. (350° F.) The means of heating is a jet of low-pressure steam, which, in its course from the boiler, passes through a series of iron pipes heated in a furnace. The quantity of acid used is in the proportion of 6 lbs. for 112 lbs. of palm-oil. In this operation, the palm-oil is decomposed, and becomes much blackened. Withdrawn at that period, it is seen that an important change has been effected by the action of the acid, as the mass now readily crystallises to a tolerably solid fat. The fat is now drawn off from the acid, and transferred to the washing-tank, where it is boiled up with water by means of a steam jet.

Distillation.—After one or two washings, the blackened fat is withdrawn, and pumped up to the supply tank, which commands the stills. The stills, which are made of copper, are heated by an open grate; each still is capable of holding five tons of fat. When charged, the temperature is raised to 293·5° C. (560° F.), and low-pressure steam passed through the mass; this steam is previously heated by passing through a system of iron pipes placed in a furnace.

The current of steam carries with it the vapour of the fatty acids, and thus facilitates the process. The mixed vapours of fatty acids and water pass together to a series of vertical pipes, which retain a temperature above 100° C. (212° F.), where the fats only condense, while the steam passes to a second refrigerator cooled by a current of water. Here it is condensed, along with the minute quantity of fat carried over by it. A separating tank, from which the water escapes at the bottom, whilst the fats float on the top, serves to recover this small quantity.

Distillation of the Residue.—After continuing the distillation for a certain period, the residue in the still is transferred to another still, formed of iron pipes, set in a furnace, and there submitted to a much higher temperature, and a jet of steam more strongly heated. The residue left in these iron stills is a sort of pitch, and is applied to the same uses as ordinary pitch. By this means an additional quantity of fatty acids is obtained.

The fatty acids, as they run from the still, are used to a great extent for the manufacture of candles, without pressing, and form what are called composite candles, which possess all the advantages of being self-snuffing, but are more fusible and softer than the pressed stearic acid candles. A large proportion of the distilled fats, however, is pressed, to make a better sort of candle; and for this purpose 50 hydraulic presses are employed.

Cold pressing.—The fats are spread by ingenious machinery on woven mats, and submitted to powerful cold pressure, between iron plates; the oleic, or metoleic acid, runs out, and is collected and chiefly exported to Germany, where it is employed in soap-making.

Hot pressing.—After cold pressing, the fat acids are subjected to hot pressure, in hydraulic presses, confined in a chamber heated by steam. The pressed cakes, after the removal of the edges, are melted in contact with a little diluted sulphuric acid, and run into blocks. When the reporters visited the works, the company were distilling at the rate of 130 tons of palm oil per week.

Moulding.—The moulding of the cheaper descriptions of candles is effected by ingenious machinery, invented by Mr. Morgan, of Manchester, and improved by the engineer of the company. By this machine eighteen candles are moulded at one time; the wicks, 60 yards long, are wound on 18 separate reels, one for each mould. As one set of candles is pushed out by a series of plungers, they draw with them into the moulds the wicks for the next lot; these wicks being held temporarily with one clip, whilst the candles are held with another, are cut off close to the candles by a traversing circular cutter. Compound forceps, having 18 holders, now seize the wicks at the open end of the moulds, and hold them in their places; the plungers then return and draw the wicks tight. The moulds which, during the operation, have remained in a horizontal position, are now turned in a vertical direction, the small end downwards, and are then passed on a railway to the person who is to fill them, they being heated to the proper temperature by their transit through a hot closet. They are then passed to other parallel railways and left to cool; after remaining a sufficient time to allow of the solidification of the candles, the moulds are brought back in succession, by means of turntables, to their first position. The forceps (which during the moulding have remained *in situ*) are now removed, and the frame of moulds again turned in a horizontal position. Eighteen plungers or pistons are made to press forward the loose bottoms of the moulds, which correspond to the small end of the candle. In pushing these forward, the candles are pressed out, and thus the cycle of operations is completed. It must be added, that the return-stroke of the piston brings back the bottoms of the moulds against shoulders provided to keep them from falling out.

Pressed cocoa-nut oil is largely employed to mix with the pressed acids of palm oil, to make the best composite candles.

Price's Candle Company (class iv., 83, p. 201) is the most colossal establishment in the world in this branch of chemical manufacture; possessed of five distinct manufactories, besides the plantation of cocoa-nut trees in Ceylon, of a capital but little short of half-a-million sterling, and employing, notwithstanding the best arrangements for economising labour, 800 work-people, it is not surprising that they divide annually in profits a sum equal to the gross returns of some of the largest continental works (between £40,000 and £50,000).

The fusing point of Price's Candle Company's candles of pressed distilled fats, obtained by distilling palm oil, is 51·30°. (124° F.); those prepared from the pressed fats obtained by distilling Chinese tallow (derived from the *Stillingia sebifera*), according to a patent taken out on the 20th of December, 1845, by Wilson, Gwynne and Wilson, fuse at 57·7°. (136° F.)

NOTES BY A PRACTICAL CHEMIST.

New method of precipitating Oxide of Tin, separating it from other bodies, and combining it with Silk, Woollen and Cotton Fabrics.—Loewenthall, whilst endeavouring to find a simple and accurate method of detecting traces of perchloride of tin in the protochloride, found that alkaline sulphates decompose the perchloride, and precipitate hydrous oxide from the solution, whilst they have no influence on the protochloride when the air is excluded. He finds that the sulphates of magnesia, alumina, protoxide of manganese, iron, zinc, and copper, peroxide of iron, produced the same decomposition; moreover, nitrates of soda, ammonia, baryta, zinc, and copper. He found the precipitate to be pure hydrated oxide of tin, never containing any of the acid of the precipitant.

This behaviour of oxide of tin admits of several useful applications:—

1. The detection of tin in almost any liquid.

2. It affords an easy and exact method of quantitatively determining tin, as well as an easy and perfect means of separating it from chlorine and other halogens, alkalies, &c. It is of especial worth to manufacturers in determining the commercial value of tin salts. The nitric acid test always gives an incorrect result, from the volatilisation of the chloride of tin.

3. It affords a very suitable means of combining oxide of tin with cotton, woollen and silk stuffs in dyeing. The author considers that this method has great advantages over the use of the expensive alkaline stannates.

4. Dark colours containing tin may be conveniently made by this means.

Preparation of Iodoform.—Dissolve 8 parts iodide of potassium in 100 parts spirit containing 90 per cent. alcohol; heat the mixture to between 95° and 104° F., and then add, in small quantities, a solution of chloride of lime; part of the iodide will be set free, and will give the liquid a deep red colour. It is to be shaken until nearly colourless, and fresh portions of chloride of lime are then to be added, repeating the operation as long as the phenomena indicated continue to occur. When, on addition of chloride, the liquor ceases to become coloured, it is to be allowed to cool, and in a little while a yellowish white flocculent matter will be deposited, consisting of iodoform and iodate of lime. The precipitate is to be collected and treated with boiling spirit containing 90 per cent. of alcohol, which will dissolve the iodoform, and deposit it in crystals as it cools. The iodate of lime results from the decomposition of part of the hypochlorite of lime and iodide of potassium. The chloride of lime may be replaced in this preparation by chlorides of potassa or soda, but these latter, besides their higher price, have the further inconvenience of forming a greater quantity of iodate than the chloride of lime.

Detection of Mercury in oily or fatty substances.—The following method serves to separate mercury in a few minutes from its combinations with oxygen and the fatty acids (ointments). However small the quantity of mercury present, the effect is, nevertheless, distinct.

The ointment to be examined is melted by the application of a gentle heat, and a small quantity of essence of citron is then added to it. Under the well-known reducing influence of this hydrocarbon, the ointment acquires a grey colour, which effect is to be promoted by stirring. After about five minutes, the ointment being still kept melted, three times its volume of ether is to be added, the whole mixed together, and then allowed to stand. The supernatent liquid is then to be decanted, and the residue washed several times with ether. The mercury left at the bottom of the vessel may now be dissolved in nitric acid, and tested with the usual reagents.

Test for Dragons' Blood. — To estimate approximately the value of a sample of dragons' blood, it is sufficient to treat a small quantity with potassa, adding excess of sulphuric acid. A sample of dragons' blood is so much the more valuable as it is soluble in potassa without change of tint, and as it takes with sulphuric acid a very pure yellow colour. A change of colour by potassa, a brown tint with sulphuric acid, would show the presence of foreign substances.

Extraction of Copper with Ammonia.—The following method serves to extract from any ore of copper all the copper, and nothing but the copper, without roasting, and leaving all the remainder of the ores: —The ore is reduced to powder, and placed with weak ammonia in a flask capable of containing, besides, air sufficient to furnish to the copper all the oxygen necessary, was agitated for a few seconds. The flask being perfectly corked, the coloration of the ammonia was instantaneous, and the oxygen absorbed produced a vacuum. The liquor, freed from ammonia, leaves oxide of copper.

It was now necessary to ascertain whether other metals, as zinc, cobalt, nickel, and silver, which might be present, and whose oxides are likewise soluble in ammonia, would not act like copper. I treated, in

the same manner, natural sulphureted, and sulpho-arsenical combinations of these metals, but there was no action. The residue did not give a trace of red coloration with prussiate of potassa, thus proving that the extraction of the copper is complete. In applying this process on the large scale, one equivalent of ammonia is required for one of copper, as the oxidation is produced by a current of air blown slowly through the liquid in which the pulverised ore is suspended. It was found that 1 kilogramme (2 lb. $3\frac{1}{2}$ oz.) of copper requires 833 cubic decimètres (3273 inches) of air.

The operation should not proceed too quickly, for, on the temperature increasing, a great part of the ammonia would be carried away.

The cupro-ammoniacal solution separated from the rest of the ore is submitted to distillation, for collecting the ammonia and employing it for subsequent operations; the oxide of copper is then separated as brilliant, black, micaceous scales, which are reduced and fused, in order to obtain the metallic copper. Putrified urine may be successfully employed. This process may be advantageously employed in assaying such minerals, as we thus obtain all the copper in the form of a button, by fusing the oxide with a little charcoal.

Direct Mode of obtaining Positive Proofs on Paper.—The collodion employed is composed of an etherial solution of gun-cotton (obtained by treating 2 grammes of cotton with a mixture of 50 grammes nitrate of potassa and 100 grammes sulphuric acid; the cotton, well washed and dried, is entirely soluble in a mixture of 10 volumes ether and 1 volume alcohol); ether and alcohol are then added, so that the finished solution is composed of 1 gramme of cotton, 120 grammes ether, and 60 grammes alcohol; then is added about 1 gramme nitrate of silver converted into iodide, and dissolved in alcohol by means of an alkaline iodide, preferably iodide of ammonium. The glass plate, covered in the ordinary manner with a thin layer of the solution, is, before it is dry, steeped in a bath composed of 1 part distilled water, $\frac{1}{12}$ nitrate of silver, and $\frac{1}{20}$ of nitric acid. The fixing takes place, as in the ordinary process, in a few seconds. The glass plate is then plunged into a bath of sulphate of protoxide of iron, and then carefully washed.

The image has remained negative until this moment; but, by plunging it into a bath of double cyanide of silver and potassium, it becomes positive and complete. It only remains to wash it, cover it with dextrine, and dry it, and then frame it on a back of black velvet.

The bath which I employ is composed of 1 quart of water, 25 grammes cyanide of potassium, and 4 grammes nitrate of silver.

ANSWERS TO CORRESPONDENTS.

"Z. E., Bromsgrove."—If you wish to study the philosophy of chemistry, we would advise you to read Daubeny on the Atomic Theory, the "Leçons sur la Philosophie Chemique," by Dumas, and the third volume of Comte's "Philosophie Positive."

"Querist."—We cannot furnish information for so questionable a purpose as the one you have in view.

"Argonaut."—The first person who applied zinc to prevent corrosion of the copper sheathing of ships was Sir H. Davy.

S.

HISTORY OF PAPER MAKING IN THE UNITED STATES.

REPORT TO THE COMMISSIONERS OF PATENTS.

Ivy Mills, Pa., Dec. 17th, 1850.

Sir,—Your favour of Nov. 30th came duly to hand. For want of documents and dates, my report of the rise and progress of the paper manufacture in the United States, must be very meagre, as I have to rely on my limited experience and observation, and on conversations with my father, long ago, to supply this deficiency.

About the year 1725, my grandfather, who was brought up to the paper business in England, came over and settled where I now reside. I have documents to prove that in 1732 he had erected a mill, and was manufacturing paper. The kind of paper then made was what is called fullers' press boards, such as are now used by clothiers to press cloth. I believe there was another mill a little north of Philadelphia, and one near Boston, similarly occupied. I believe also there existed an Act of Parliament at that time, prohibiting the manufacture of any other kind of paper in the colonies. As there were few books then published in the colonies, the progress of the paper manufacture was very slow, and so continued until about the dawn of the Revolution. My grandfather manufactured the paper for Dr. Franklin, who was publishing a newspaper in Philadelphia, and who was a frequent visitor at the mill. About the time my grandfather made the paper for the continental mouey, he commenced making writing-paper, supposed to be the first made in America. From the Revolution until the year 1820, very little improvement occurred that was important; very little machinery introduced for facilitating the operation. The mills increased in number in proportion to the increased quantity of newspaper and book publishing. About the year 1810, we began to experience a deficiency of raw material (rags), and were obliged to resort to Europe for supplies. These were obtained from all parts of Germany and Italy, and have continued increasing up to the present time. Whether the deficiency at home resulted from a real scarcity of rags, or their low price made it no longer an object to families to preserve them, I cannot say, but such was the fact.

At present we have an additional inducement to import our material. The article of cotton has here almost entirely superseded the use of linen for wearing apparel, and when much worn and reduced to rags, becomes a very tender substance; in fact, scarcely able to support its weight when made into paper. The foreign rags, we suppose, average about 80 per cent. of linen, which, when mixed with the domestic cotton, imparts to the paper a strength and firmness which it could not have without it. The best qualities of writing and printing papers contain from 30 to 50 per cent. of linen, for which we are entirely depending on foreign countries. But as the use of cotton for clothing is yearly increasing all over the civilised world, we find the proportion of linen in imported rags decreasing from 5 to 10 per cent. from year to year. We have an excellent substitute for this in our own country, did not its high price prevent its use—raw cotton—which makes a beautiful paper when mixed with the worn-out rags of the same material. In 1837-8, when the price was as low as 6 cents per pound, large quantities were manufactured into paper.

From 1820 to 1830, some efforts were made to introduce machinery from Europe. England and France were before us in its introduction. Several machines were sent out from England—some very imperfect, and the cost too great for our manufacturers. The patronage then offered was no inducement to our own machinists to construct so expensive a machine; until 1830, about which time, Phelps and Spafford, of Windham, Connecticut, made one which answered very well. Soon after, the country was supplied at a reasonable cost, and equal in quality to the best English. Not long afterwards, Howe and Goddard, of Worcester, Massachusetts, commenced making them. I have reference only to the Fourdrinier—the shaking endless wire-web machines. I believe these two establishments now make all these machines in the United States. The *cylinder* machine, more simple and less costly than the other, is in more general use; but the paper made on it is not equal in quality. Notwithstanding, it does very well for news and the various purposes which a coarser article will answer for. These are made in various places throughout the United States.

The interval from 1830 to 1840 was important for the vast improvements made in the manufacture by the application of this kind of machinery for that purpose. Also, by the introduction of the use of chlorine in the form of gas, of chloride of lime, and the alkalies, lime and soda-ash in bleaching, cleansing, and discharging the colours from calicoes, worn out sail, refuse tarred rope, hemp, bagging and cotton waste, the refuse of the cotton mills. These articles which heretofore had been considered only applicable for the manufacture of coarse wrapping papers, have, through the application of this bleaching and cleansing process, entered largely into the composition of news and coarse printing papers, and consequently have risen in value 300 per cent. A few mills possess machinery, and adopt a process by which they are prepared for the finest printing and letter paper. I have seen a beautiful letter paper made of cast-off cable rope. Hemp bagging is an excellent material for giving strength, and is in great demand, especially for making the best newspaper. The cost of making paper by machinery, compared with that of making it by the old method (by hand), not taking into account the interest on cost, and repair of machinery, is about as one to eight. The present low price resulting from improved machinery, and the low price of printing by steam power, have placed newspapers and books in the hands of all; and a great increase of production has followed within the last few years. I have no data by which I could furnish a report of the comparative increase within the last ten or fifteen years. The quantity now made might be nearly ascertained, if the deputy marshals could report the number of *engines* in operation; I suppose 300lbs. of paper would be the average daily produce of each engine, taking into consideration the loss of time and power from a deficiency of water in the summer season. There has been a greater proportional increase of mills in the middle and western states within the last ten years, than in the east. Ten years ago I suppose 80 per cent. of the supplies for Philadelphia came from east of the North River; at present, I think there does not come 20 per cent. Formerly, a much greater quantity was sent west of the mountains, and large quantities of rags brought in return. In consequence of the greater number of mills in the west, particularly in Ohio, New Orleans, I am informed, is in a great

measure getting supplies there. Formerly, they all went from the Atlantic states.

From the time of the Revolution, the quantity of paper imported has been gradually decreasing; and, before the revision of the tariff in 1846, had dwindled to perhaps not more than 2 per cent. of the amount consumed, with the exception of wall papers, of which large quantities were imported and still continue to be from France. Since 1846, there has been an increase of cheap French letter paper, but the amount is small compared with the whole amount of letter paper consumed—probably not more than 3 per cent. There is also a small quantity of ledger and letter paper brought from England; but as the American is quite equal in quality, the importation is gradually diminishing. Within the last two years, great ingenuity has been exercised both in England and in the United States, in trying to make a paper by machinery to resemble the old fashioned hand-made *laid* paper (yet preferred by many). To the eye, it is a pretty good imitation, but lacks the toughness, firmness, and surface of the hand made. By an experienced judge the deception is easily discovered, notwithstanding large quantities have been used, under the supposition that they were hand made. The reduced price of machine paper has forced almost all manufacturers to abandon the old method. I believe there are only two mills in operation in the United States in which it is made by hand, one in Massachusetts, and one of mine. There is a limited quantity of particular kinds that can be better made by hand than on a machine. In mine is made bank note, laid letter, deed parchments, and such as are used for documents that are much handled, and require great strength and durability. Within the last few years some improvement has been made in the finish of writing and printing papers, by the introduction of iron and paper calenders, for the purpose of giving a smooth surface. The finish of American papers, I think, is now equal to any in the world.

Very respectfully, your obedient servant,
JAMES M. WILLCOX.

Thos. Ewbank, Esq., *Washington, D.C.*

[We have never met with any paper equal in strength to the wrapping paper sent with our American parcels. It is not of very great substance, and is of a whitey-brown colour, with a tinge of buff. The difficulty of tearing open a parcel pasted up is something marvellous. Is this from the quality of the material, or from the absence of bleaching?—Ed. *Artizan.*]

BRITISH ASSOCIATION.

SECTION F.—STATISTICS.

Dr. Strang, of Glasgow, read the following paper in this section:—

PROGRESS AND EXTENT OF STEAMBOAT BUILDING AND MARINE-ENGINE MAKING ON THE CLYDE.

As I have already stated, it is just forty years since the first steamboat was built on the Clyde; and up to the present period all the steamers employed in the navigation of the river, its firth and estuaries, have been constructed either at Glasgow, Greenock, Port Glasgow, or Dumbarton. Although for some years these river steamers were both limited in number and small in size, I find that, in 1831, the number of steam vessels then regularly sailing from the Clyde amounted to 55, with an aggregate tonnage register measure of 4,905, while, in 1835, the vessels had increased to 67, and the tonnage to 6,691. Since that period the steamboat traffic from Glasgow has nearly doubled, as the following figures will best illustrate :—

Number and register tonnage of steamers engaged in traffic on the river Clyde, during the year ending June, 1852.

	No.	Tonnage.
Trading steamers	39	8,643
Passenger do.	31	2,522
Tug do.	22	827
	93	11,992

From the foregoing table it appears that, in the course of seventeen years, the number of regularly employed steamboats has increased from 67 to 93, and the tonnage from 6,691 to 11,992. While this no doubt exhibits a great and growing progress of the steamboat traffic between Glasgow and the various places with which it thereby communicates, it gives no idea whatever of the extent and magnitude to which steamboat building and marine-engine making have reached during these few years past. Previous to the last ten years, in fact, these branches of industry on the Clyde and elsewhere may be said to have been in their infancy ; but no sooner was the problem of ocean steam navigation solved, than a stimulus was given to the construction of steam vessels altogether extraordinary. The following tables, which have been constructed from returns made to me by the various ship builders and engineers in Glasgow, Dumbarton, Greenock, and Port Glasgow, will best illustrate the

EXTENT OF STEAMBOAT BUILDING AND MARINE-ENGINE MAKING ON THE CLYDE.

TABLE FIRST.

Number of Steam Vessels and Power of Marine Engines built or made at Glasgow and Neighbourhood, from 1846 to 1852.

Yrs.	No. of Ves.	Wood. No.	Iron. No.	Pad-dle. No.	Screw. No.	Wood. Ton-nage.	Iron. Ton-nage.	Engines' Horse Power. Wood Hull.	Engines' Horse Power. Iron Hull.	Engines' Horse Power for Vessels not built on Clyde.
1846,	11	—	11	11	—	—	5,717	—	2,490	300
1847,	11	—	11	11	—	—	6,152	—	2,650	—
1848,	13	—	13	10	3	—	4,464	2,810	2,081	580
1849,	16	—	16	13	3	—	9,799	—	2,756	120
1850,	16	—	16	9	7	—	7,255	1,660	2,237	180
1851,	20	—	20	11	9	—	14,321	—	4,299	140
1852,	36	1	35	15	21	200	22,733	2,140	6,026	3,400
	123	1	122	80	43	200	70,441	6,610	22,539	4,720

From the foregoing table it appears that, during the last seven years, there have been constructed, or are now constructing at Glasgow and in its neighbourhood, 123 vessels ; of which 1 was of wood, 122 of iron, 80 paddle, and 43 screw, consisting of 200 wooden tonnage, 70,441 iron tonnage, 6,610 horse-power engines for wooden hulls, 22,530 horse-power engines for iron hulls, and 4,720 horse-power engines for vessels not built on the Clyde.

TABLE SECOND.

Number of Steam Vessels and Power of Marine Engines built or made at Dumbarton from 1846 to 1852.

Yrs.	No. of Ves.	Wood. No.	Iron. No.	Pad-dle No.	Screw. No.	Wood. Ton-nage.	Iron. Ton-nage.	Engines' Horse Power. Wood. Hull.	Engines' Horse Power. Iron Hull.	Engines' Horse Power for Vessels not built on Clyde.
1846,	5	—	5	2	3	—	1,080	—	—	—
1847,	7	—	7	2	5	—	1,439	—	—	—
1848,	5	—	5	2	3	—	650	—	—	—
1849,	4	—	4	2	2	—	1,264	—	—	—
1850,	8	—	8	2	6	—	3,136	—	400	—
1851,	9	—	9	5	4	—	3,908	—	610	—
1852,	20	—	20	5	15	—	18,284	—	2,605	200
	58	0	58	20	38	0	29,761	0	3,615	200

From the preceding table it appears that, during the last seven years, there have been constructed, or are now constructing, in Dumbarton, 58 vessels all of iron, 20 being for paddles and 38 for screws, and having a tonnage of 29,761, and during the last three years 3615 horse-power engines have been made there for iron hulls, and 200 horse-power engines for vessels not built on the Clyde.

TABLE THIRD.

Number of Steam Vessels and Power of Marine Engines built or made at Greenock and Port-Glasgow from 1846 to 1852.

Yrs.	No. of Ves.	Wood. No.	Iron. No.	Pad-dle No.	Screw No.	Wood. Ton-nage.	Iron. Ton-nage.	Engines' Horse Power. Wood Hull.	Engines' Horse Power. Iron Hull.	Engines' Horse Power for Vessels not built on Clyde.
1846,	1	—	1	1	—	—	328	—	—	—
1847,	8	3	5	8	—	5,485	3,923	—	1,120	410
1848,	16	2	14	11	5	2,117	5,178	—	640	354
1849,	3	1	2	2	1	285	450	—	150	260
1850,	8	3	5	3	5	4,813	3,400	65	845	440
1851,	13	1	12	6	7	2,402	7,093	—	1,260	800
1852,	17	3	14	10	7	3,029	8,699	64	1,424	2,250
	66	13	53	41	25	18,131	29,071	129	5,439	4,514

From the above table it appears that, during the last seven years, there have been constructed, or are now in progress of construction, at Greenock or Port-Glasgow, 66 steam vessels, of which 13 were of wood and 53 of iron, 41 paddles and 25 screws, consisting of 18,131 wood tonnage, and 29,071 iron tonnage, 129 horse-power engines for wooden hulls, 5,439 horse-power engines for iron hulls, and 4,514 horse-power engines for vessels not built on the Clyde.

TABLE FOURTH.

Number of Steam Vessels and Power of Marine Engines built or made at all the ports on the Clyde from 1846 to 1852.

Yrs.	No. of Ves.	Wood. No.	Iron No.	Paddle. No.	Screw. No.	Wood. Tonnage.	Iron. Tonnage.	Engines' Horse Power. Wood Hull.	Engines' Horse Power. Iron Hull.	Engines Horse Power for Vessels not built on Clyde.
1846,	17	—	17	14	3	—	7,125	—	2,490	300
1847,	26	3	23	21	5	5,485	11,514	—	3,770	410
1848,	34	2	32	23	11	2,117	10,292	2,810	2,721	934
1849,	23	1	22	17	6	285	11,513	—	2,906	380
1850,	32	3	29	14	18	4,813	13,791	1,725	3,842	620
1851,	42	1	41	22	20	2,402	25,322	—	6,169	940
1852,	73	4	69	30	43	3,229	49,716	2,204	10,055	5,850
	247	14	233	141	106	18,331	129,273	6,739	31,593	9,434

On examining the foregoing table it will be found that, during the last seven years, the steam vessels built and the marine engines made, including those at present constructing, have been as follows:—number of steam vessels built—wood hulls, 14; iron hulls, 233; in all, 247; of these 141 were paddles and 106 screws. The tonnage of the wooden steamers amounts to 18,331, of the iron to 129,273. The engines' horse power in wood hulls was 6,739, the engines' horse power in iron hulls was 31,593; while there was of engines' horse power constructed for vessels not built on the Clyde 9,434, making a grand total of 247 steamers, amounting to 148,704 tons, and of engines 47,766 horses' power.

From these tables also may be gathered the fact that wooden hulls for steamers are giving place to those of iron, and that the screw is more patronised than the paddle. Of the whole vessels constructed during 1852, or in progress of construction, at the various building yards on the Clyde, amounting to 73, only 4 were of wood, while the proportion of screws to paddles is as 43 to 30.

Before leaving the present extent of the branch of industry under consideration, it may perhaps be as well to state that, in addition to the steamboats and marine engines constructed on the Clyde, there has been and is at present a large business carried on in steam dredgers and iron punts, not only for maintaining and extending the Clyde navigation itself, but also for improving other rivers and harbours. On the Clyde alone there are at present in daily use 5 dredging machines, 4 of these having one row of buckets and the other two; the average horse power of the 4 is 20 each, and the average draught of water 4 feet 2 inches, capable of dredging to a depth of 18 feet, the cost being about £4000 each. The draught of the double-bucket machine is 5 feet 1 inch, and can dredge to the depth of 22 feet; its cost was £8000. At this moment, one engineering house in Glasgow is engaged in constructing a dredging machine of 20 horse power for Riga, and another of similar power for Copenhagen. The advantages arising from the use of such machines may at once be appreciated when it is mentioned that in 1824, when the first steam dredger was set at work in the Clyde, the average depth of water at ordinary tides was scarcely 10 feet; whereas at present the average depth is above 17 feet.

Having now given some idea of the extent of steamboat building, &c., on the Clyde, let me next attempt to arrive at some probable idea of its value and importance as a branch of the business and industry of the district in which it is located. This, however, is a more difficult task than it would appear at first sight to be, arising from the great variety of circumstances which affect the price of different sizes and kinds of steamers, and particularly from the great difference occurring in what may be designated their general and cabin furnishings. As a proof of this, I may mention that, of the 14 ocean steamers for the British and American Royal Mail Service, which were all built and fitted out in the Clyde, and which commenced at a cost for each ship of about £50,000, the last, from increased size and power, reaches upwards of £110,000, an increase of price far greater than the increase of power and tonnage. From all I can gather from those best conversant with the subject, I am inclined to assume as an approximation to the truth the following prices :—

Wooden hulls of all sizes, irrespective of the cost of engines, boilers, and machinery, and exclusive of all furnishings, £14 per ton ; iron hulls as above, £12 do. The general and cabin furnishings, as I have already stated, are so various, according to the employment intended for, and style of finish, that no price per ton can be named as a general rule. It may be said to range from £6 to even as high as £15, but I shall assume the average of all kinds to be £8.*

The cost of engines also varies greatly according to size, description of engine, and style of finish. Contracts will be taken at from £25 to £50 per horse power. I shall assume £25 as a fair average. Proceeding then upon this hypothesis, the value for the whole seven years will be as follows :—

Wooden hulls, tonnage,	18,331	at £14	£256,634
Iron do. do.,	129,273	— 12	1,551,276
General furnishings, &c.,	197,604	— 8	1,180,832
Marine engines,	47,766	— 35	1,661,810
			£4,650,552

Showing an annual average of £664,364.

If, however, we take only the two last years' completed work, and include in it what is now constructing, the annual average for these two years will £1,253,636.

While this certainly looks a large sum, it by no means fully exhibits the value of this branch of industry, for the above sum only represents new vessels and new machinery, and has no reference whatever either to the enlargement of vessels or to the ordinary and extraordinary repairs made on the old.

To show that the amount of steamboat repairs in the Clyde must be very considerable, I may state that, in the coure of five years, one steamship, which originally cost £29,000, paid £12,500 for repairs, or upwards of 10 per cent. yearly of its value ; and that another steamship, during seven years, originally costing £37,000, paid £12,700 for repairs. Of these repairs the carpenter got £9526 ; the engineer, £12,405, and sundry other parties, £3269.

If, from the want of data, we only approximate the value of this industry, we can at least state the number of persons employed in the various building yards and engine-shops connected with the construction and repair of steam vessels on the Clyde. At present, the number employed, is as follows :—

Glasgow, &c.	6,210
Greenock and Port-Glasgow	3,250
Dumbarton	1,360
In all	10,820

Here, then, we have the fact, that this branch of industry gives work and support to no less than 10,820 individuals ; and when we consider the high wages given to many of the engineers, and the respectable rate of remuneration paid to even the lowest person engaged in the business, it is perhaps not too much to assume, that the average of the wages paid to all classes of men and boys will amount to at least 16s. per week, and consequently the trade circulates £8,656 weekly, or £450,112 annually, of wages.

* I have been furnished with the cost in detail of a vessel of 604 tons, and of 320 horse power engines :—

Building hull	£7,852	
Joiners' and smiths' account	1,953	
Upholstery	754	
Plumbers	318	
Painter and cabinet-maker	273	
Sails, ropes, and rigging	354	
Copper	363	
Carving and gilding	907	
Other accounts	563	
		13,337
320 horse-power engine at £42		13,440
		£26,777
Silver plate, crystal, crockery, bed and table linen, and steward's department		2,223
		£29,000

The above shows that, while the hull cost £13 per ton, the furnishings cost £9 per ton, and the plate, &c., £3 per ton.

SHIPBUILDING ON THE CLYDE.

RENFREW.

Messrs. James Henderson and Sons, Patent Slipway, launched from their building-yard, on the 13th of August, an iron steam dredger, for Copenhagen, which will be the first vessel of the kiud in Denmark.

Builders' measurement.	ft.	ins.
Length of keel and fore-rake	100	0
Breadth of beam	23	0
Depth of hold (to skin)	9	0
Tonnage	$244\frac{62}{94}$ tons	

Customs' measurement.	ft.	tenths.
Length on deck	99	0
Breadth on do., amidships	22	4
Depth of hold, do.	7	$2\frac{1}{2}$
Length of boiler-room	21	0
Breadth of do...	22	0
Depth of do.	8	4
Length of engine-room	12	0
Breadth of do.	22	4
Depth of do.	8	3
Length of wings of do.	10	8
Breadth of do.	9	2
Depth of do.	8	3

	ft.	tenths.
Length of bucket-well	65	0
Breadth of do.	4	2
Depth of do.	8	3

Tonnage.	Sectional Act.	Act for foreign vessels.
Hull..	$168\frac{74}{100}$ tons.	$123\frac{67}{100}$ tons.
Bucket-well	$24\frac{6}{100}$ „	$24\frac{6}{100}$ „
Total, deducting bucket-well	$144\frac{68}{100}$ „	$99\frac{61}{100}$ „
Boiler-room	52 [illegible] „	52 [illegible] „
Engine, do.	$24\frac{1}{100}$ „	$24\frac{1}{100}$ „

Tonnage.	Sectional Act.	Act for foreign vessels.
Wings of do. ..	$8\frac{92}{100}$ tons.	$8\frac{92}{100}$ tons.
Boiler, engine-room, and wings ..	$84\frac{93}{100}$ „	$84\frac{93}{100}$ „
Register	$59\frac{75}{100}$ tons.	$14\frac{68}{100}$ tons.

One direct aeting engine (crank over head) of 20 horse (nominal) power; diameter of cylinder, 26 inches × 3 feet length of stroke; the air-pump wrought by levers from the cross-head of the cylinder; one eommon flue boiler, length 8 feet 8 inches; breadth, 10 feet; depth, 5 feet 8 inches; two furnaces, length of fire-bars, 4 feet 4 inches; breadth, 2 feet; depth, 3 feet; steam-chest, length above, 3 feet; do. below, 3 feet 6 inches; breadth, 3 feet 3 inches; depth, 3 feet; chimney, 2 feet 6 inches × 20 feet 6 inches. There are 36 buckets, and will be eapable of dredging at 26 feet depth of water. The uprights for supporting the shafts, tumbler, and erank, are of wrought-iron. Frames of hull, 3 × 3 × $\frac{3}{8}$ inches, and 2 feet 3 inehes apart. Built upon the same prineiple as the Glasgow dredgers. The draft of water, with maehinery, will be 2 feet 6 inehes.

Hull, boiler, and buckets by Messrs. James Henderson and Sons, Patent Slipway, Renfrew; engines by Messrs. Murdock, Aitken, and Co., engineers, Hill-street, Glasgow, 1852.

Messrs. J. W. Hoby & Co., engineers and iron ship-builders, launched from their building-yard, on the 27th of March, an iron steam dredging-machine, for the port of Leith.

Dimensions.	ft.	tenths.
Length on deck	89	2
Breadth on do, amidships	29	4
Depth of hold, do.	8	0
Length of bucket-well	50	0
Breadth of do.	10	5
Depth of do.	8	0
Length of engine-space	19	5
Breadth of do.	29	4
Depth of do.	7	4

Tonnage.	Tons.
Hull	$216\frac{32}{100}$
Bucket-well	$46\frac{53}{100}$
Hull, deducting bueket-well ..	$169\frac{79}{100}$
Contents of engine-spaee	$45\frac{91}{100}$
Register	$113\frac{88}{100}$

Fitted with a pair of oscillating engines, which are aft; two tubular boilers, one on each side of the vessel; and two funnels. The bucket-ladders are in the centre of the vessel, there being two, discharging the mud over the stern-frames, two feet apart.

Also upon the stocks, nearly ready to launch, a serew steam-vessel, for the London and Welsh trade, having a clipper bow, to be fitted with a pair of inverted eylinder engines, and two tubular boilers, &e.

Also, built and shipped, five iron luggage-vessels, for the Danube Steam Navigation Company; four of them have been shipped on board of the *Best Bower* (serew steamer), for Hamburg; the other on board of a sailing-vessel.

Dimensions.	ft.	ins.
Length of keel and fore-rake	180	0
Breadth of beam	25	0
Depth of hold	9	0
Tonnage	$552\frac{87}{94}$ tons.	

GOVAN (GLASGOW).

Messrs. Smith and Rodger, iron shipbuilders, launched from their building yard here, on the 18th of August, a very handsome screw-propeller steam vessel, named the *Ceres*, the property of the Waterford Commercial Steam Navigation Company, and is intended to ply between London and Rotterdam.

Dimensions.	ft.	ins.
Length of keel and fore-rake	200	0
Breadth of beam, extreme	27	0
Depth of hold	14	9
Tonnage	$718\frac{49}{94}$ tons.	

Fitting a pair of steeple engines (4 piston rods, on Mr. David Napier's patent), of 102 horse (nominal) power; diameter of cylinders, 40 inches × 2 feet 6 inches length of stroke; diameter of screw 10 feet. Two boilers on Messrs. Lamb and Summers' patent; has a common bow, with a poop. Bust, female figure head, sham galleries, three masts, sehooner rigged, stationary bowsprit. Port of Waterford.

ERRATUM.

In the description of the *Plata*, page 183, for "960 horse (nominal) power," read "910 horse (nominal) power;" and for "10 feet length of stroke," read "9 feet length of stroke;" also for paddle wheels' diameter effective "27 feet," read "37 feet."

NEW GLASGOW, PROVINCE OF NOVA SCOTIA.

Mr. George M'Kenzie launched from his building-yard last year the frigate-built ship, *Hamilton Campbell Kidston* (of Glasgow), which was the largest sailing-vessel that ever entered this harbour. Sailed from Glasgow for Port Phillip, South Australia, with a full complement of passengers, &c., on the 20th of April, under the command of Mr. Arthur Chisholm. Has three decks (flush); round-sterned; a full female figure-head; and is owned by Messrs. Potter, Wilson, and Co., merchants, forming one of their monthly line of Australian traders.

Dimensions.	ft.	tenths.
Length on deck	168	0
Breadth of do., amidships	32	0
Depth of hold, do.	29	4
Tonnage (British Registry Aet)	$1{,}444\frac{2}{100}$ tons.	

DUMBARTON.

Messrs. Denny and Rankine launehed from their building-yard, on the 31st of July, a very handsome ship, the *Aberfoyle* (of Glasgow), the property of Messrs. Peter and Thomson Aitkman, merchants. Has a roundhouse on deck aft; classed 13 years; a bust male figure-head (Rob Roy). Sailed on the 17th from Greenock for Melbourne, Port Phillip, with 414 passengers, and a erew of 36 persons.

Dimensions.	ft.	tenths.
Length on deck..	167	9
Breadth on do., amidships	30	7
Depth of hold, do.	22	5
Tonnage, new	$965\frac{7}{100}$ tons.	
Do. old	$883\frac{60}{94}$ „	

They have just laid down the keel of an iron clipper ship for the Australian trade, to be flush on deck; will have deck-houses.

Dimensions.	ft.	ins.
Length on deck	185	0
Breadth of beam	30	0
Depth of hold	19	0
Tonnage	$799\frac{44}{94}$ tons.	

Stem, keel, and stern-post, 9 × $2\frac{1}{4}$ inches; plates, $\frac{3}{4}$ to $\frac{5}{8}$ and $\frac{1}{2}$ ineh; frames, 5 × 3 × $\frac{1}{2}$ inches, and 15 inches apart. Is owned by James Smith, jun., Esq., merchant, Liverpool (late of Greenock).

Also, just laid down, the keel of a 13 years' barque, flush on deck, to carry a large cargo on a light draft of water, intended for the Port Natal and Clyde trade.

Dimensions.	ft.	ins.
Length of keel and fore-rake	125	0
Breadth of beam	25	0
Depth of hold	17	0
Tonnage	$368\frac{58}{94}$ tons.	

Messrs. Alexander Denny and Brother, iron ship-builders, launched from their building-yard, on the 14th of September, a very beautifully-modelled paddle steam-yacht, to ply upon Loch Lomond.

Dimensions.	ft.	ins.
Length of keel and fore-rake	145	0
Breadth of beam	15	0
Tonnage	$164\frac{58}{94}$ tons.	

To be fitted with a pair of oseillating engines by Mr. Mathew Paul, engineer.

THE KHAMES POWDER COMPANY'S AUXILIARY IRON SCREW STEAM-VESSEL, "GUY FAWKES."

Built and fitted by Messrs. Napier and Crichton, engineers and iron ship-builders, Glasgow, 1849.

Dimensions. Builders' measurement.	ft.	ins.
Length of keel and fore-rake	64	2
Breadth of beam	14	8
Depth of hold	8	3
Length of engine-space	26	4

Tonnage.	Tons.
Hull	$64\frac{51}{94}$
Contents of engine-space	$30\frac{71}{94}$
Register	$33\frac{74}{94}$

New measurement.	ft.	tenths.
Length on deck	63	4
Breadth of do., amidships	14	2
Depth of hold, do.	8	3
Length of engine-space	26	4

Tonnage.	Tons.
Hull	$54\frac{60}{100}$
Contents of engine-space	$32\frac{96}{100}$
Register	$21\frac{64}{100}$

One horizontal engine of 7 horse (nominal) power; diameter of cylinder, 16 inches × 2 feet 4 inches stroke. One vertical air pump, diameter 9 inches × 2 feet 4 inches length of stroke; wrought off the crank shaft end, being attached by means of a beam and connecting-rod, 4 feet 6 inches long; diameter of screw, 4 feet 4 inches; pitch, 6 feet 6 inches; 3 blades. Driving wheel, diameter 5 feet 4 inches, and 90 teeth; one set of cogs, each $5\frac{1}{2}$ inches on face; pinion, diameter 2 feet 9 inches; pitch, $2\frac{1}{4}$ inches, and 44 teeth. One tubular boiler, length 8 feet 9 inches; breadth, 6 feet; depth, 6 feet 6 inches; 28 tubes, diameter $3\frac{1}{4}$ inches × 5 feet long. Two furnaces; length of fire-bars 4 feet 4 inches; breadth of ditto, 2 feet 2 inches; depth, 2 feet 8 inches; funnel, diameter 21 inches × 16 feet. Bunkers hold 6 tons of coal. Stem, stern-post, and keel, $4\frac{3}{4}$ × $1\frac{3}{4}$ inches; frames $2\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{3}{8}$ inches, and 2 feet apart; eight strakes of plates from keel to gunwale. Is divided into 4 water-tight compartments, by means of 3 bulk-heads; has a house on deck, aft, for the accommodation of the crew; length inside, 11 feet $1\frac{1}{2}$ inches; breadth of ditto, 6 feet; depth, 4 feet $5\frac{1}{2}$ inches. The boiler and funnel are placed 10 feet from the end of boiler to centre of funnel, by means of a cylindrical flue, and water space under the deck aft, with a small steam chest, which is close aft to the stern post; the funnel top raking out over the stern about 4 feet. Every improvement that could be thought of to lessen the danger of explosion, by keeping machinery and powder apart, has been adopted. Average revolutions per minute, 64 of engines, screw about 128 revolutions; steam pressure, 16 lbs. per square inch; consuming 3 cwt. of coals per hour. Average load—draft of water, 6 feet forward, and 7 feet 6 inches aft. Has made the voyage from Liverpool to Rothsay, a distance of about 200 miles, having on board 65 tons of saltpetre, at the rate of 8·16 miles per hour; employed in conveying gunpowder throughout Great Britain and Ireland: and has been over on the continent, &c.

DESCRIPTION.

No figure head or galleries, topping-up bowsprit, two masts, felucca rigged, one deck (flush), elliptical sterned and clinch-built vessel. Port of Glasgow; commander, Mr. James Stewart.

THE HAMBURGH AND LEITH STEAM NAVIGATION COMPANY'S NEW IRON SCREW STEAM VESSEL "HOLYROOD."

Built and fitted by Messrs. Smith and Rodger, engineers and iron shipbuilders, Glasgow, 1852.

Dimensions.	ft.	tenths.
Length on deck	191	5
Breadth on do., amidships	25	0
Depth of hold, do.	15	5
Length of engine space	45	4
Tonnage	$533\frac{30}{100}$ tons.	
Contents of engine and gearing space	$175\frac{13}{100}$ „	
Register	$358\frac{26}{100}$ tons.	

One pair of geared steeple engines (on Mr. David Napier's patent 4-piston principle), of 98 horse (nominal) power; diameter of cylinders, 40 inches × 3 feet stroke; diameter of screw, 10 feet; pitch, 11 feet; 2 blades; two tubular boilers; stem 5 × 2 inches; keel 6 × 2 inches; frames 4 × 3 × $\frac{1}{2}$ inches, and 18 inches centre to centre. Round-house amidships for cabins, &c.; length 42 feet, breadth 18 feet, height 7 feet, with accommodation for 38 passengers. Round-house aft for the accommodation of the officers and crew; length 15 feet, breadth 12 feet, depth 6 feet 6 inches. Capacity of hold for measurement goods, 802 tons; ditto of bunkers for coals, 110 tons. Launched, February 21st. Draft of water, mean, 6 feet; displacement, 260 tons. Steam pressure, 12 lbs. per square inch; consuming 13 cwt. of coals per hour, and making 44 revolutions per minute; draft of water, average 10 feet. Has made the voyage from Leith to Hamburg in $46\frac{1}{2}$ hours, the quickest ever done on this station.

DESCRIPTION.

A shield figure head, sham galleries, elliptical sterned and clinch-built vessel, flush on deck, stationary bowsprit, 3 masts, barque rigged, clipper bow. Port of Leith; commander, Mr. Robert Cook.

THE CALEDONIAN RAILWAY COMPANY'S NEW IRON PADDLE STEAMERS, "HELENSBURGH," AND "DUNOON."

Built by Messrs. Laurence, Hill and Co., iron shipbuilders, Inch-green, Port Glasgow. Engine and boilers by Messrs. Scott, Sinclair and Co., engineers, Greenock, 1852.

Dimensions.	*Helensburgh.* ft.	tenths.	*Dunoon.* ft.	tenths.
Length on deck	135	0	135	0
Breadth on ditto, amidships	15	0	15	0
Depth of hold, ditto	7	2	7	3
Length of engine space ..	33	2	33	2
Hull	$114\frac{90}{100}$ tons		$114\frac{91}{100}$ tons	
Contents of engine space ..	$38\frac{80}{100}$ „		$39\frac{34}{100}$ „	
Register	$76\frac{10}{100}$ tons		$75\frac{57}{100}$ tons	

One steeple engine (having two piston rods) in each vessel, of 43 horse (nominal) power; diameter of cylinder 37 inches, × 3 feet 3 inches stroke; fitted with feathering paddle-wheels, diameter 14 feet; ten floats, 4 feet 3 inches × 1 foot 5 inches. One tubular boiler, length 9 feet 8 inches; breadth 9 feet 6 inches; depth 7 feet. Steam chest, length above, 5 feet 10 inches; ditto below, 8 feet; breadth above, 4 feet 6 inches; ditto below, 7 feet 3 inches; depth 4 feet 5 inches. Three furnaces, length 5 feet 6 inches; breadth 2 feet 6 inches; depth 3 feet. 106 (malleable iron) tubes, diameter $3\frac{1}{4}$ inches × 6 feet 6 inches. Funnel, diameter 2 feet $7\frac{1}{2}$ inches × 23 feet 3 inches. Steam pressure, 18 lbs. The engine makes 36 revolutions per minute, consuming 9 cwt. of coals per hour. The keel, stem, and stern-post are all welded in one entire piece, 4 × 1 inch; frames $2\frac{1}{2}$ × $2\frac{1}{4}$ × $\frac{1}{2}$ inch; and 1 foot 8 inches apart amidships, and 2 feet apart fore and aft; keel plates, $\frac{5}{16}$ths of an inch; gunwale ditto $\frac{1}{4}$ of an inch. The cabins are neatly and tastefully fitted up. *Helensburgh* is plying on the station from Greenock to Helensburgh, Row, Roseneath, Shandon and Gareloch Head, in connection with the Glasgow, Paisley, and Greenock branch of the company's railway. Launched May 10th; draught of water at launching 2 feet 3 inches forward, and 2 feet 7 inches aft; draft with machinery, &c., 3 feet 10 inches forward, and 4 feet 2 inches aft. *Dunoon* plying on the station from Greenock to Gourock, Dunoon, and Rothesay, &c. Launched June 7th; draught of water at launching, forward 2 feet 4 inches, aft 2 feet 6 inches; ditto with machinery, mean 3 feet $10\frac{1}{2}$ inches. No figure head, galleries, bowsprit, mast, or rig; one deck (flush); square-sterned and clinch-built vessel; common bow. Port of Greenock.

Helensburgh, commander, Mr. Alexander Mac Pherson.

Dunoon, commander, Mr. Alexander Shields.

MERCANTILE CUSTOMS AN IMPEDIMENT TO INDUSTRIAL PROGRESSION.

By Professor Solly.

Even a slight examination of the raw produce which forms the chief basis of our manufactures must lead us to the conclusion that, in many cases, the best substances are not used, nor are the best modes of preparing them followed. The history of every art gives us plenty of illustrations to show what apparently trifling circumstances have led to the use of some particular substance, and how long it has been before that substance has given way on the introduction of a new material, even though the new material was confessedly superior to that previously in use. The cause of this has, no doubt, in part, been the tenacity with which men in all cases cling to old customs and practices, and the cautious disinclination which prudent men generally have to enter into a new process; whilst, in many cases, it has certainly arisen from a combination of those in trade, determined to prevent any alteration, or the introduction of any new substance. But, at the same time, there is no doubt that ignorance, on the part of the manufacturer, of what was his true interest, has been at the very foundation of this opposition to change.

If you were to place before any manufacturer specimens of all the substances which could be employed in this particular manufacture, and if you could tell him from whence each could be procured, its cost, the quantities in which he might obtain it, and its physical and chemical properties, he would soon be able to select for himself the one best suited for his purposes. This, however, has never happened in relation to any one art; in every case, manufacturers have had to make the best of the materials which chance or accident has brought before them. It is strange and startling, but nevertheless perfectly true, that, even at the present time, there are many excellent and abundant productions of nature, with which not only our manufacturers, but, in some instances, even our men of science, are wholly unacquainted. There is not a single book published which gives even tolerably complete information on any one of the different classes of vegetable raw produce, at present under our consideration.

The truth of these remarks will be felt strongly by any one who takes the trouble to examine any of these great divisions of raw materials. He will obtain tolerably complete information respecting most of those substances which are known in trade and commerce; but of the greater number of those not known to the broker he will learn little or nothing. Men of science, for the most part, look down upon such knowledge. The practical uses of any substance, the wants and difficulties of the manufacturer, are regarded as mere trade questions, vulgar and low—simple question of money. On the other hand, mere men of business do not feel the want of such knowledge, because, in the first place, they are ignorant of its existence, and secondly, because they do not see how it could aid them in their business; and if it should happen that an enterprising manufacturer desires to learn something of the cultivation and production of the raw material with which he works, he generally finds it quite impossible to obtain any really sound and useful information. In such cases, if he is a man of energy and of capital, he often is at the cost of sending out a properly qualified person to some distant part of the globe, to learn for him those practical details which he desires to know. This is no uncommon thing; and many cases might be stated, showing the great advantages which have arisen to those who have thus gained a march upon their neighbours.

This want of knowledge, arising as it does from a want of communication between the first producer and the manufacturing consumer, is the great cause why some of our manufactures advance so slowly, and why some branches of commerce are in so depressed a state. A moment's consideration will suffice to show the bearing of this fact. Let us take the case of a gum, a resin, or a vegetable extract, collected by a native in the vast forests of Hindostan, and used by the calico-printer of Manchester; what connection have these two with each other? and what knowledge has the former of the purposes to which it is to be applied, or the latter of the sources whence it is derived? The native collector sells the raw produce to the native buyer or broker, having generally taken care to adulterate it to a greater or lesser extent; the native broker sells it again to the merchant; the merchant consigns it to a house in England; and the English house employs their broker to introduce it to the manufacturer. Perhaps the article, from careless collection, or from intentional adulteration, is greatly depreciated in value; still the manufacturer must use it, for he cannot get any better; he consults his broker, and learns that it is the best in the market, and that it always comes over in that state. So matters go on from generation to generation; and for want of a little knowledge, rightly applied, all parties persevere in a system which, whilst it invariably increases labour, at the same time certainly diminishes profit.

It would lead me too far from the subject now under our consideration, were I to consider the effects produced in trade by these "middlemen" and intermediate agents. I would now, therefore, only point out to you the effect which they produce in retarding the spread of knowledge. No doubt such a system has its advantages as well as its objections; that it tends to keep up the old rule-of-thumb mode of going on there is likewise no doubt; and also that, with all its faults, and the inconveniences which it causes to manufacturers, they would be very sorry to see it in any way changed. It sometimes happens, that a merchant rashly endeavours to set aside the old prejudice, and presumes to bring his goods directly to the manufacturer; if he does so, he is generally eyed with distrust and suspicion, and is told, as I have not unfrequently myself heard, "Really we cannot entertain the thing in this form; you had better send it to us in the ordinary way, through a broker." I do not for a moment mean to say, that this may not be the most business-like mode of proceeding; my object merely is to point out how this system tends to check improvement, and how the manufacturers, though they suffer from its effects, cherish and combine to uphold

it. It may be taken as a pretty well-ascertained fact, that only those manufactures are in really a progressive state of which the producer of the raw material and the manufacturing consumer are in more or less direct communication, and where there is a mutual knowledge of the capabilities of the one, and the requirements of the other. When there are many intermediate agents between the two, it is long before the complaints of the manufacturer reach the ears of the first producer, and it must be many years before the improvement which the former desires can be brought about.

Such a system of trade offers no facilities for the introduction of new kinds of vegetable raw produce; a new substance, like a new process, is looked on with distrust. It "is not in the market," the broker does not know it, and that is nearly the same as pronouncing it of no value; it is put up to auction, sold for a tenth part of its value, and what becomes of it is a mere chance. Sometimes it falls into the hands of clever and enterprising men, a demand for it rapidly arises, and it is then afterwards brought to market; but more frequently it is thrown aside as useless, because no pains are taken to apply it in the right manner, and in a couple of years it is altogether forgotten, or, if remembered, it is as a worthless thing which was tried some years since, and found of no use; and, lastly, the report goes back to the country from which it was brought, that it is of no value in the European markets.

NOVELTIES.

Holm's Variable Eccentric.—Mr. C. A. Holm, who is well known in the mechanical world for his inventive ability, has just shown us a plan which he lately designed for a method of varying the throw of a crank or eccentric, in a case where there was not room for the ordinary slotted crank usually employed. A reference to the engraving will explain it in a moment. Fig. 1 is a front view of the eccentric; and fig. 2 a side view in section. *a* is the shaft from which the motion is communicated, on which is keyed an eccentric disc, *b*. In the centre of this disc is a stud, *c*, which is screwed into the centre of another disc, *d d*. This latter disc has a pin, *e*, fixed in it, eccentric, from which the motion required is given. Supposing the shaft *a* to revolve, it is clear that the stroke given to the pin, *e*, will be double the radius from centre of *a* to centre of *e*. But if the screw, *c*, be slackened, the disc, *d d*, can be turned round until the centre of *e* is brought over the centre of *a*, when *e* will have no motion at all. And any point

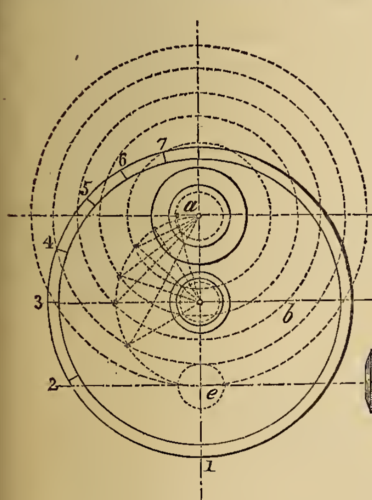


Fig. 1.

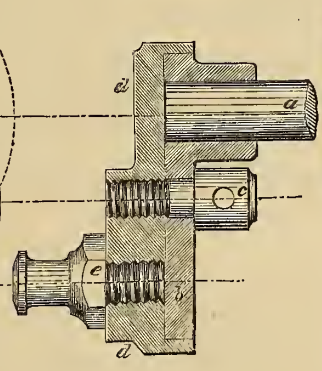


Fig. 2.

between these two will give a different stroke, as shown by the dotted lines in fig. 1. Lines are engraved on the edge of the disc, as 1, 2, 3, 4, 5, 6 & 7, which give the different ranges of stroke. There are so very many cases where a convenient method of lengthening and shortening the stroke of a crank is a desideratum, that we attach great value to this simple contrivance.

In small slotting and planing machines, various forms of expansion-gear, &c., it will come into play; and it has the great recommendation of being nearly all lathe work, which, as we all know, is the cheapest work done in an engineer's shop.

Reichenbach's Shop-front Lamp.—The lighting of shops from the outside presents so many advantages over inside lights, that it is a wonder they are not universally adopted. The eye of the spectator sees only the brilliant goods, the eyes being protected from the glare of the lamp; more room is given in the window for the display of goods; they are not subject to the effects of the unconsumed gas (which in drapers' and similar shops is a heavy loss); and the shop is kept cooler. Amongst the best we have seen are Mr. Reichenbach's (of Borough-road, Southwark) "Photoros Lamps," which are represented in the accompanying engraving. Fig. 1 is a front elevation, and fig. 2 a side elevation. *a* is the pendent gas-burner; *b*, the concave reflector, in the focus of which the gas-burner is placed; *c* is a rim of perforated metal, to which the frame of the parabolic glass, *d*, is hinged, so as to admit of its being readily opened and cleaned; *e* is the chimney; *f*, a set screw, for adjusting the position of the reflector; *g g*, an arm secured to the pendent, *a*, upon the end of which the reflector swings. The shape of the lamp is well adapted for the complete diffusion of the light over the whole shop window, whilst the facility of adjustment is a great convenience.

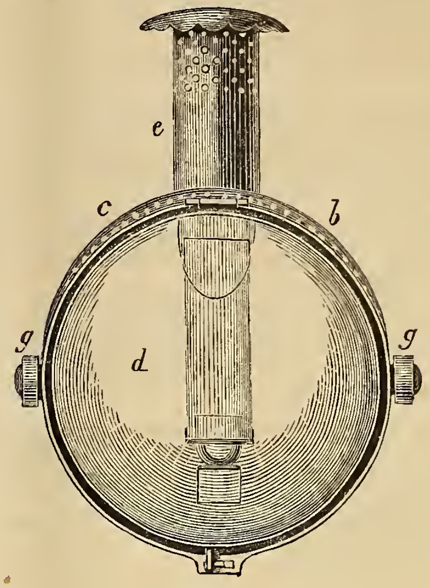


Fig. 1.

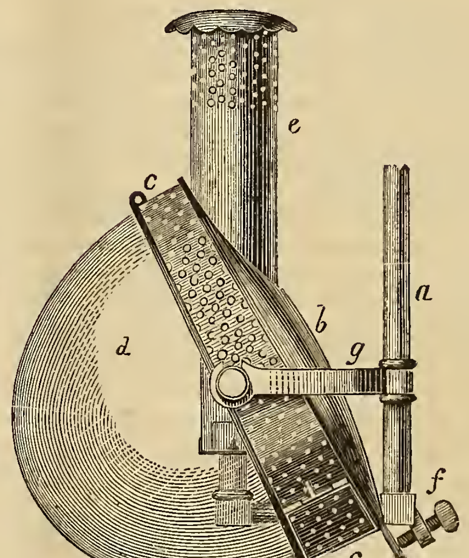


Fig. 2.

Fife's Curved-point Pen.—Mr. Fife, who is a Professor of caligraphy from the United States, has submitted to us one of his curved-point pens, the principle of which is shown in the accompanying sketch. Mr. Fife says, "The excellence of a well-made quill pen is acknowledged by all; yet few are aware of the cause of that excellence, namely, that it bends laterally at the point, in making shades, and, consequently, becomes an *oblique pen*." A moment's consideration will show that, as pens are ordinarily held, the line of motion of the points does not coincide with the line which they ought to follow; and Mr. Fife's pen gets over this difficulty very satisfactorily, as we have found by using it for some time.

NOTES FROM CORRESPONDENCE.

*** We cannot insert communications from anonymous correspondents.

"A Boiler-maker."—Mr. Mills' patent consists in staying sheet water spaces, by bulging out the plates at regular intervals until they touch each other. The bulges come into the fire spaces, and give more water room and heating surface. The bulges may be carried the whole length of the fire, so as to divide the depth of it into a series of fire spaces. We think the question between this and Lamb and Summers' resolves itself into convenience of manufacture, in the absence of any comparative trial of their evaporating qualities.

"H. M. S. *Arrogant*."—We have received (too late for insertion in this number), a letter from the late chief engineer of the *Arrogant*, in which he denies ever having given Mr. Isherwood the information which he refers to (p. 203), or, indeed, ever having seen that gentleman in his life. This seems to demand some explanation from Mr. Isherwood.

"Patent Amendment Act."—The regulations just issued are of little importance. Specifications are to be written on both sides of a sheet of parchment, 18 inches by 12, with a margin of 1½ inch on each side. But the drawings may be on larger sheets of parchment.

"B. H."—We cannot condescend to enter into a personal discussion with such an unscrupulous perverter of facts as Mr. Mushet, but our correspondent may take our word for it, that Mr. Craddock has never yet attained a greater economy than has been already arrived at with double cylinder engines using 50 lbs. steam. At least, if he has done so, he has never shown it to the public.

"R. N."—The table of the comparative expenses and receipts of screw and paddle-wheel vessels will be found in the *Artizan* for February, 1847. 2. Our correspondent may get some hints on light steam boats from the narrative in the January, 1851, *Artizan*.

Books received.—"Booth's Encyclopedia of Chemistry;" "The Assayer's Guide;" "Scott on Water Supply," &c.

LIST OF ENGLISH PATENTS,

From 23rd of August to 24th September, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Henry Needham Scrope Shrapnel, of Gosport, for improvements in ordnance and fire-arms, cartridges, and ammunition, or projectiles, and the mode of making up or preparing the same. August 23.

Frederick Dam, of Brussels, chemist, for improvements in preventing incrustation in boilers. August 23.

Josiah George Jennings, of Great Charlotte-street, Blackfriars-road, brass-founder, for improvements in water-closets, in traps and valves, and in pumps. August 23.

Julius Roberts, of Portsmouth, lieutenant in the Royal Marine Artillery, for improvements in the mariners' compass. August 23.

Auguste Edouard Loradoux Bellford, of Castle-street, Holborn, for improvements in the machinery and apparatus for printing fabrics and other surfaces. (Being a communication.) August 26.

Paul Joseph Poggioli, of Paris, France, gentleman, for an improved medical compound. August 26.

George Twigg, of Birmingham, button manufacturer, for certain improvements in the manufacture of buttons and other dress-fastenings, and in the machinery and apparatus to be used therein. August 26.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in the application of iron to building purposes. (Being a communication.) August 26.

John Fish, of Oswaldtwistle, Lancaster, for certain improvements in looms for weaving. August 26.

Andrew Crosse, Esq., of Broomfield, Somerset, for improvements in the extraction of metals from their ores. August 26.

Pierre Amable de Saint Simon Sicard, chemist, of Paris, for improvements in enabling persons to remain under water and in noxious vapours. August 26.

James Lawrence, of Colnbrook, Middlesex, brewer, for improvements in brewing apparatus. August 26.

William Henry James, of Great Charlotte-street, Surrey, civil engineer, for improvements in heating and refrigerating, and in apparatus connected therewith. September 3.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for improvements in producing gas, and in its application to heat and light. (A communication.) Sept. 7.

John James, of Leadenhall-street, London, manufacturer, for certain improvements in weighing machines and weighing cranes. September 9.

Henri François Toussaint, of Paris, gentleman, for improvements in obtaining a product from the wood of the cactus. September 10.

Julian Bernard, of Guildford-street, Russell-square, Middlesex, gentleman, for improvements in the manufacture or production of boots and shoes, and in materials, machinery, and apparatus connected therewith. September 10.

John Wright Treeby, of Elizabethan Villa, St. John's Wood, Middlesex, gentleman, for improvements in regulating the flow of liquids. September 10.

Stephen Taylor, of New York, gentleman, for certain improvements in the construction of fire-arms, and in cartridges for charging the same. September 10.

Alexander Stewart, of Glasgow, North Britain, manufacturer, for improvements in the manufacture or production of ornamental fabrics. September 10.

Frederick Sang, of 58, Pall-mall, Middlesex, artist in fresco, for certain improvements in floating and moving vessels, vehicles, and other bodies on and over water. September 16.

Charles Augustus Peller, of Abchurch-lane, London, merchant; John Eastwood, of Bradford, York, woolcomber; and Samuel Gamble, of Bradford aforesaid, machine-maker, for improvements in machinery for combing, drawing, or preparing wool, cotton, silk, hair, and other fibrous materials. September 16.

John Macintosh, of New-street, Surrey, civil engineer, for improvements in manufacturing and refining sugar. September 18.

James Pillans Wilson, of Belmont, Vauxhall, Surrey, gentleman, for improvements in the manufacture of cloths, and in the preparation of wool for the manufacture of woollen and other fabrics, and in the preparation of materials to be used for these purposes. Sep. 18.

John Mitchell, of Calenick, Cornwall, for improvements in purifying tin ores, and separating ores of tin from other minerals. September 18.

William Smith, of Little Woolstowe, Bucks, farmer, for improvements in machinery for reaping. September 18.

George Hutchinson, of Glasgow, merchant, for a method of preparing oils for lubricating and burning. September 18.

James Warren, of Montague-terrace, Mile-end-road, and Barnard Peard Walker, of North-street, Wolverhampton, for improvements in the manufacture of screws and screw-keys, and in the construction of bridges applicable to floorings, roofings, and paving. Sept. 18.

Moses Poole, London, gentleman, for improvements in combining caoutchouc with other matters. September 18.

François Mathieu, of Hatton-garden, Middlesex, gentleman, for improvements in apparatus for containing, aërating, refrigerating, filtering, and drawing-off liquids, and in ornamenting such apparatus. September 23.

John Lawson and Edward Lawson, both of Leeds, machine-makers, for improvements in machinery for scutching and cleaning flax straw. September 23.

Jacques Leon Tardieu, of Paris, gentleman, for certain improvements in the colouring of photographical images. September 23.

Robert Bowman Tennent, of Gracechurch-street, London, merchant, for certain improvements in the mode of pulping cherry coffee, and in the machinery applicable thereto. September 24.

LIST OF SCOTCH PATENTS,

From 2nd of August to the 18th of August, 1852.

Joseph Haythorne Reed (late of the 17th Lancers), of the Harrow-road, Middlesex, gentleman, for improvements in saddlery and harness. August 2.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the construction of wheels for carriages. (A communication.) August 3.

John Gerald Potter, of Over Darwen, Lancaster, carpet manufacturer, and Mathew Smith, of the same place, manager, for certain improvements in the manufacture of carpets, rugs, and other similar fabrics. August 6.

Ralph Errington Ridley, of Hexham, Northumberland, tanner, for improvements in cutting and reaping machines. August 6.

William Ackroyd, of Berkenshaw, near Leeds, for improvements in the manufacture of yarn and fabrics, when cotton, wool, and silk are employed. August 6.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of metallic fences, which improvements are also applicable to the manufacture of verandahs, to truss frames for bridges, and to other analogous manufactures. (Communication.) August 13.

Robert Hardman, of Bolton-le-Moors, Lancaster, mechanic, for improvements in looms for weaving. August 18.

LIST OF IRISH PATENTS,

From the 19th of July to the 17th of August, 1852.

Robert John Smyth, of Islington, Middlesex, for certain improvements in machinery or apparatus for steering ships and other vessels. July 19.

Frederick Sang, of Pall-mall, Middlesex, artist in fresco, for certain improvements in machinery or apparatus for cutting, sawing, grinding, and polishing. July 19.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 166, Fleet-street, in the city of London, patent agents, for improvements in the purification and decoloration of oils, and in the apparatus employed therein. (Communication.) July 19.

Richard Parris, of Long-Acre, Middlesex, modeller, for improvements in machinery or apparatus for cutting and shaping cork. July 22.

Joseph Maudslay, of the firm of Maudslay, Sons, and Field, of Lambeth, Surrey, engineers, for improvements in steam engines, which are also applicable wholly, or in part, to pumps and other motive machines. July 22.

Charles Augustus Preller, of Abchurch-lane, London, gentleman, for improvements in the preparation and preservation of skins and animal and vegetable substances. July 22.

James Joseph Brunet, of the Canal Iron-Works, Poplar, Middlesex, engineer, for certain improved combinations of materials in shipbuilding. (Communication from Lucien Arman, of Bordeaux, France.) August 5.

Henry Graham William Wagstaff, of Bethnal-green, Middlesex, candlemaker, for improvements in the manufacture of candles. August 5.

James Pilling, of Rochdale, Lancaster, for certain improvements in looms for weaving. August 20.

Edmund Morewood, of Enfield, Middlesex, and George Rogers, of the same place, gentlemen, for improvements in the manufacture of metals, and in coating or covering metals. August 5.

Ralph Errington Ridley, of Hexham, Northumberland, tanner, for improvements in cutting and reaping machines. August 5.

George Laycock, late of Albany, United States of America, dyer, but now of Doncaster, York, tanner, for improvements in unhairing and tanning skins. August 6.

James Warren, of Montague-terrace, Mile-end-road, gentleman, for improvements applicable to railways and railway carriages, and improvements in paving, applicable to bridges and flooring. August 17.

Francis Joseph Beltzung, of Paris, engineer, for improvements in the manufacture of bottles and jars, of glass, clay, gutta percha, or other plastic materials, and stoppers for the same, and in machinery for pressing and moulding the said materials. August 17.

DESIGNS FOR ARTICLES OF UTILITY,

From 19th of August, to the 23rd of September, 1852.

August 19, 3353, J. Newman, Soho-square, "Colour box."
„ 21, 3354, S. S. Phillips, Chelmsford, "Hot-water stove."
„ 24, 3355, T. Gibson, jun., Manchester, "Shirt front."
„ 26, 3356, F. G. Yates, Winksworth's-buildings, "Lever knife."
„ 26, 3357, F. G. Yates, Winksworth's-buildings, "Box for string, &c."
„ 28, 3358, C. Carr, Stockport, "Spindle, rail, and bearings, for spinning, doubling, and winding machines."
„ 28, 3359, R. Clark, Strand, "Fastening for the nozzle of candle-lamps."
„ 28, 3360, W. Sanderson, Sheffield, "Balance-handle for knives and forks and table steels."
„ 30, 3361, E. Harris, Ebby, near Stroud, "Corrugated zinc wash slab."
„ 31, 3362, J. Dicker, Islington, "Traductor."
September 2, 3363, J. Blackwood and Co., Long-acre, "Tablet diary."
„ 2, 3364, Deane, Dray and Co., London Bridge, "Gas stove."
„ 4, 3365, J. Higgins, Oldham, "Hollow furnace door-frame for steam-boilers."
„ 6, 3366, W. Estwick, Hoxton, "Ventilating tent."
„ 6, 3367, R. Grundy, Rio de Janeiro, "Boat crane."
„ 8, 3368, T. Young, Little Todrig, Scotland, "Traction apparatus for horse thrashing-machines."
„ 11, 3369, A. Aubert, Nantes, France, "Oyster opener."
„ 15, 3370, S. and M. Meyer, Bow-lane, Cheapside, "Joint for parasols, umbrellas, fishing-rods, &c."
„ 17, 3371, E. D. Stones, Sheffield, "Somacephalic bath."
„ 17, 3372, J. Carrington, Potton, Bedfordshire, "Girth."
„ 18, 3373, J. W. Ingram and Co., Birmingham, "Printing-press."
„ 18, 3374, J. C. Meredith, Birmingham, "Clog-fastener."
„ 23, 3375, C. Dain, Southampton, "Perpetual daily indicator."

PLATE XVIII

DEAL SAW FRAME.

BY MESSRS. WORSSAM & Co.

LONDON

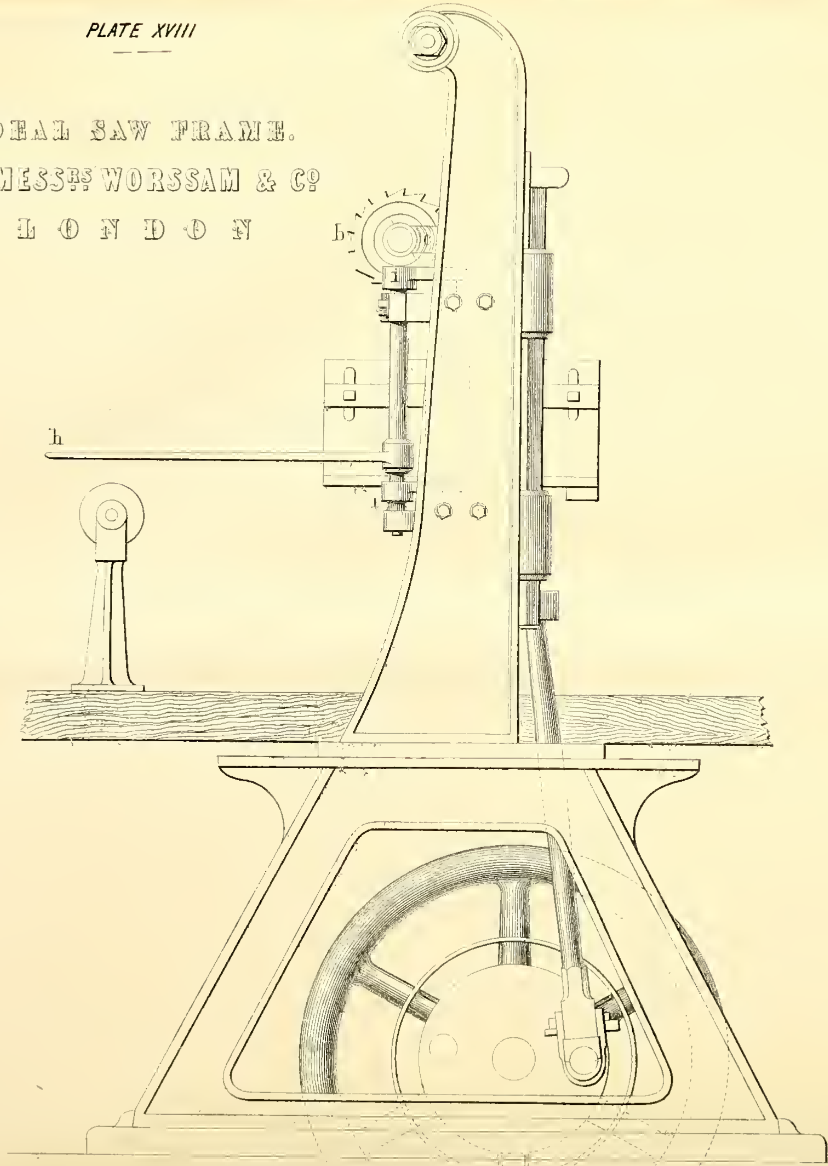


Fig 1

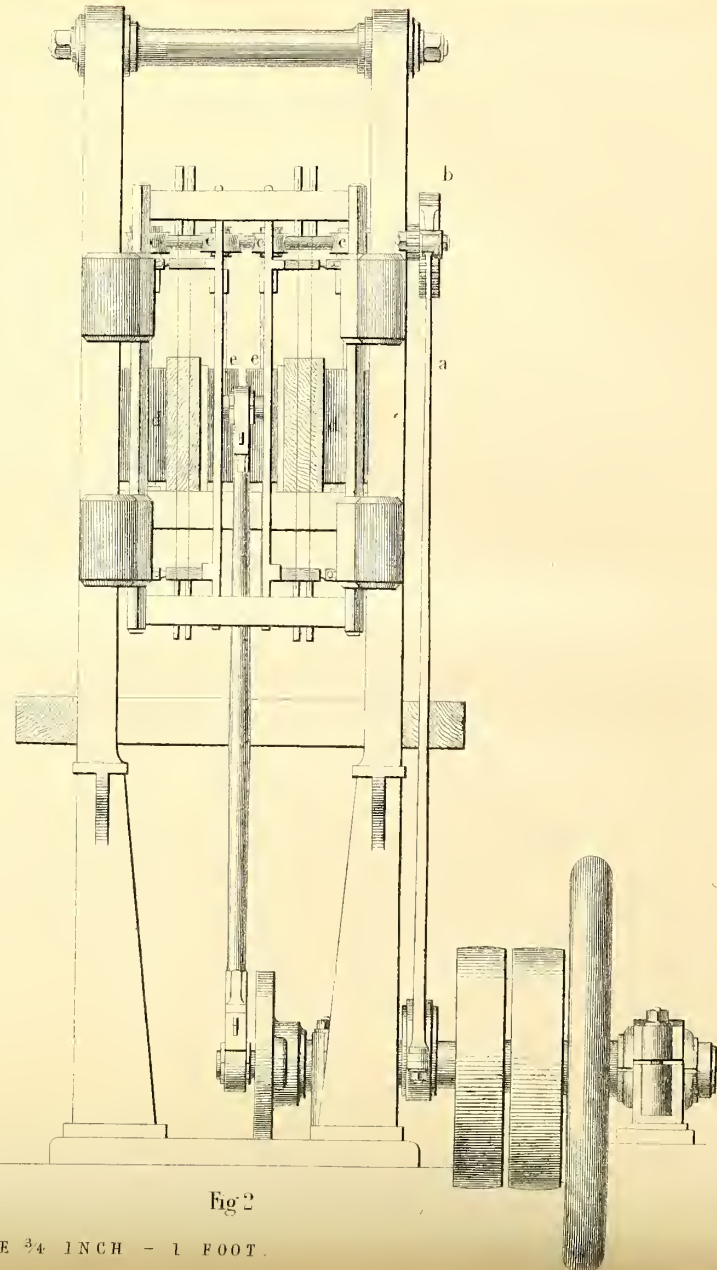


Fig 2

SCALE ¾ INCH – 1 FOOT.

W. F. Whytehead C.E. direx

R S B Sc

MASON'S

PATENT CONDENSER OR ENDLESS CARDING ENGINE FOR WOOL,

& SELF ACTING FEEDER FOR *ANY* SECOND OR FINISHER CARDING ENGINE

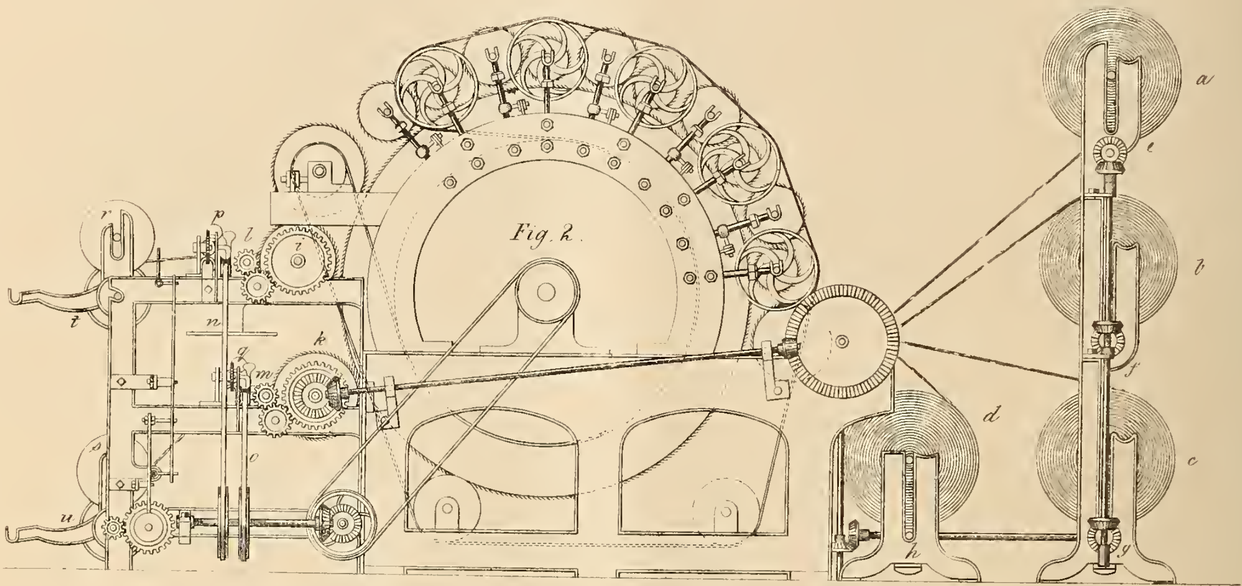
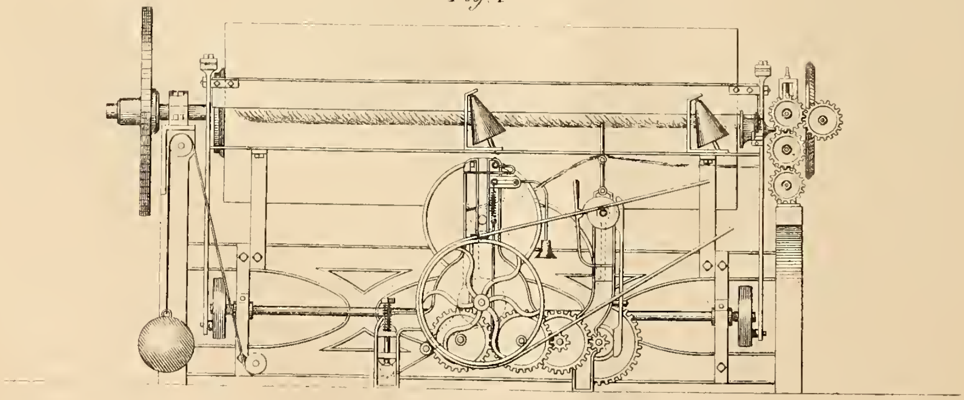


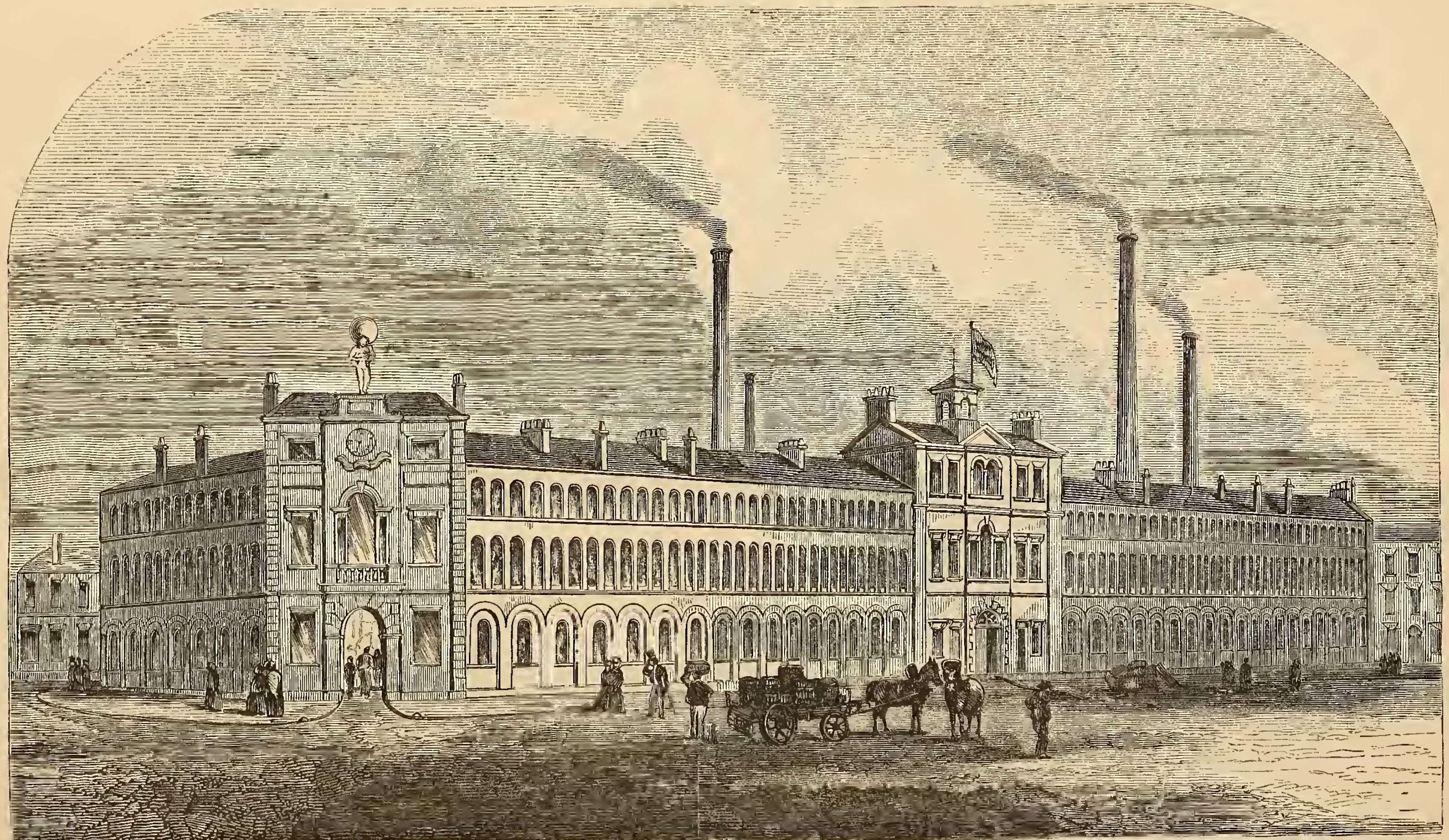
Fig. 2.

Fig. 1



W. K. Whytehead C. E. direx.

ILLUSTRATIONS OF FACTORY ARCHITECTURE.



THE ATLAS WORKS, SHEFFIELD,

PROPRIETORS, MESSRS. WILLIAM W. CUTTS AND COMPANY.

MESSRS. WEIGHTMAN, HADFIELD AND GOLDIE, ARCHITECTS.

W. K. Whytehead, C.E., direx.

THE ARTIZAN.

No. XI.—Vol. X.—NOVEMBER 1st, 1852.

EVENTS OF THE MONTH.

Comparatively few persons are aware of the immense efforts now being made by engineers and shipbuilders to meet the demands made upon them by the numerous steam navigation companies. There probably never was such a glut of work as at the present moment. We will just glance at what is doing in London. Messrs. James Watt and Co., of Soho, are said to have seventeen pairs of marine engines in hand; one pair, of 300 horse power, for the *Mauritius*, General Screw Company's vessel, are now being put on board the ship, and they are working day and night, with relays of men, to get her off by the 10th of November. Messrs. Maudslay and Field have a number of boats fitting for the same company, and a yacht (if a vessel of 2,000 tons and 800 horse power can be called by that name) for the Pacha of Egypt. These latter are Siamese engines, and have four double-beat valves, on the American principle, the same as in the *Orinoco*, and which are said to enable the engines to be handled by one man. Messrs. Blyth have two screw boats building by Messrs. Green for the Portuguese government, for which they are making the engines; they have also several pairs of paddle-wheel engines in hand for the Danube Steam Navigation Company. Messrs. Miller, Ravenhill, and Salkeld have two paddle-wheel vessels fitting for the Austrian Lloyd's, which, from their lines, promise to be clippers; they have oscillating engines and feathering wheels. Mr. Penn has just finished the trunk engines of the *Agamemnon*, and is likely to have those of 1,000 horse power for the *Royal Albert*. He has also those in hand for the *Himalaya*, which is building by Messrs. Mare and Co., and looks a fearful size. The same builders have also three other vessels on the stocks, one a "Sandwich-built" wooden vessel, for the Peninsular Company, as we understood.

We may also mention, that Messrs. T. and J. White, of Cowes, and Mr. Thompson, of Rotherhithe, are building "Sandwich" vessels, for which Mr. Penn is making the engines.

Another firm has also been lately added to the list of London engineers, that of Messrs. Tennant, Humphreys and Dyke, who have taken the premises lately occupied by Messrs. Rennie at Deptford. Mr. Tennant is well known as the proprietor of the St. Rollox Chemical Works, Glasgow. Mr. Humphries, late of Woolwich Dockyard, does not require any introduction to the engineering world. We understand they have some orders from the Danube Company. In the above notice, we have confined ourselves to marine engineering, but we may add to the list, Messrs. Simpson and Co., who are just completing four Woolf engines of 200 horse power each, for the new water works at Kingston. Messrs. Easton and Amos, who have a large quantity of paper-mill work on hand, as well as a large saw mill, for Mr. Myers, the builder, with a host of minor names. When to this list we add what is going on on the *Clyde*, the *Mersey*, the *Tyne*, and the *Avon*, the aggregate is overwhelming.

Most of the continental *ateliers*, of which we have accounts, are in a similar state of prosperity. On a recent visit to Paris, we had the pleasure of seeing the principal engineering establishments there, the chief of which is certainly that of Messrs. Cail and Company (formerly Cail, Derosne and Co.), well known for their sugar machinery. The drawing office of this establishment would serve many engineers for an erecting shop, and contained some five-and-twenty draughtsmen. The number of men employed is about 600, but the company have various branch establishments, such as boiler-makers', and ironfounders' shops, at other places. They are making several heavy express locomotives with outside cylinders on Crampton's patent, a system which appears to find more favour in France than it has done in England. We observed in all the French shops which we visited that the heavy planing machines are constructed so that the work is fixed, whilst the tool moves on the same plan as that described at p. 96, but with pitch-chains to move the table carrying the tool—a manifestly inferior arrangement to that described.

M. Cavé has a large establishment, but the arrangements are of a rather antiquated character. A favourite kind of engine appeared to be a long-stroked horizontal oscillating variety, for non-condensing, and the Woolf engine for condensing.

M. Decoster is chiefly engaged in constructing flax-spinning machinery, engineers' tools, &c., and has lately introduced a novel method of lubricating bearings, especially applicable to light shafting. The bearing is made rather wider than usual, and a small disc is fitted on the shaft, which dips into a reservoir of oil in the base of the hanging carriage or plummer-block, and by its revolution raises the oil and distributes it over the bearing. A tight-fitting cap covers in the whole bearing, and prevents the access of dust. Bearings of this description, we are assured, will run for more than a twelvemonth with one supply of oil. We ought to mention that M. Decoster is replacing all his lying shafting with shafting of a very much smaller diameter, but running at a much higher speed. This arrangement saves great expense in constructing mills, and is attended with no inconvenience, if the system of lubricating just described is adopted.

M. Nillus, of Havre, marine engine-maker and iron ship-builder, has a very elegant shop, well fitted with tools. The form of engine usually adopted is the oscillating variety; and we observed that all the most recent improvements had been adopted with great discrimination. Dimensions of some of M. Nillus's vessels will be found at another page. The shop is entirely independent of external assistance, for they make all their own forgings with a heavy steam hammer, their own copper and brass-work, coke, &c.

The remainder of our notes we must reserve for another occasion. We have said sufficient to show that our continental brethren are not behind us, either in the adoption of new improvements, or in the means of carrying them out.

DEAL SAWING FRAME, BY MESSRS. WORSSAM AND CO.

(Illustrated by Plate 18.)

In our last number we gave a description of the timber frame of Messrs. Worssam and Co., and we now present our readers with a plate of their frame for sawing deals, of which they have a number at work. It is designed, as usual, to take in two deals abreast, and the frame being divided down the middle, the connecting rod takes hold of the centre, so as to diminish the total height of the frames, without cramping the length of the connecting-rod. The motion of the deals is given by means of rollers, which have the great advantage over a rack, that they do not require to be run back to put in fresh deals.

Fig. 1 is a side elevation, and fig. 2 an end elevation of the frame. Motion is communicated to the feeding rollers by the eccentric and rod *a*, acting on the ratchet *b*, the spindle of which is provided with four endless screws, taking into the screw wheels *c, c, c, c*. On the spindles of these wheels are the feeding rollers, *d, e, d, e*, which grip the deals, and, by their revolution, move them against the saws. In order to suit the varying thicknesses of wood, the outer rollers, *d, d*, are mounted in such a way as to admit of their being adjusted, as to their distance, from the inner rollers, *e, e*. This is effected by the roller spindle being carried by the levers *i, i*, which are mounted on a spindle commanded by the lever *h*, to which weights may be attached in the usual way, to give the roller the required pressure against the wood.

MASON'S PATENT WOOL MACHINERY AND SELF-ACTING FEEDER.

(Illustrated by Plate 19.)

In order that the reader not intimately acquainted with the minutiæ of the arrangements of the woollen manufacture may appreciate the value of the "labour-saving" machines patented by Mr. Mason, of Rochdale, of which we give drawings in plate 19, we deem it best to give a short detailed account of the processes of wool-spinning, as generally adopted.

The machine to which the wool is first subjected closely resembles the cotton willow, with which our readers are presumed to be familiar. Previous to being passed through this, the wool is sprinkled with oil, which facilitates its working. After being willowed, it is projected from the machine in a loose, open state. It is then passed to the "scribbling engine," as it is termed, which is, in fact, a carding engine, similar in its action to the "breaker card" used in the cotton manufacture. On passing from the engine, it is wound round a roller ready for the next machine, which is termed the "carding engine." The carding teeth are placed on the periphery of the cylinder, in the form of narrow strips, thus passing the material out in the shape of narrow bands. Before, however, these bands are finally passed from the machine, they are separately caused to go between a fluted roller, which is encased by a semicircular shell. Passing between these surfaces, the band is rubbed round into the shape of a tube, or hollow card, of a certain length, termed "cardings." In cases where the carding cylinders are of considerable length, the cardings are divided into two parts, thus making them of sufficient length to be handled without breaking. In single carding engines the length of card corresponds with the length of cylinder. The tubes or rolls of wool are next passed to the "slubbing machine." The principle of this machine is identical with that of the cotton-roving frame. The wool cardings are, however, supplied in a different way to the action of the machine. In the "slubbing billy," as it is termed by the operatives, the cardings are placed upon a sloping board, or feed-apron, placed in front of the machine, and which is of equal length with its breadth. The cardings are placed on this board, at a certain distance one from another, depending upon the distance at which the "drawing rollers" are placed in the machine. The cardings are taken through between the rollers, and drawn up the inclined board. The cardings, thus elongated, are finally wound round upon bobbins.

The cardings, as we have seen, being all of a determinate length, it is necessary, in order to keep the rollers always supplied, to piece the cardings; that is, to add a new length to the end of the one which may happen to be nearly passed through the rollers. To do this is the work of the little attendants called the "pieceners," and so well do they perform this, that we do not recollect ever seeing any of the drawing rollers "needlessly revolving" for lack of their usual supplies. Up to this point, then, the operations have been threefold—"scribbling," "carding," and "slubbing," and the attention necessitated for three engines, involving a great number of "pieceners." It is here that Mr. Mason's labour-saving machines come into operation, dispensing with three operations—feeding the carding engine, piecing the cardings at the "billy," and the operation of the billy itself. How this is effected it is now our duty to explain. The wool, on being taken from the "scribbling" or first carding engine, in the usual way, is passed through a revolving tube, seen in fig. 1, plate xix, which gives it a certain amount of false twist. It is next drawn through the tube by a pair of rollers, and returned between a lower pair to the small lap machine in front of the engine, which is arranged to form a lap of sliver 16 inches diameter, and 4 or 5 inches wide. When the required length of sliver is wound on, notice is given by a bell, and if not attended to, another movement doffs the lap, so as to insure each one being of the same uniform length.

A number of these narrow laps are placed side by side upon rods, so as to form four rows, seen at *a, b, c, d*, fig. 2, each row being the whole width of the engine, and are turned off into the engine by the unlapping rollers, *e, f, g, h*; each sliver passes through a separate guide as it enters the feed rollers, to keep it in its proper place.

The wool having passed through the engine and been carded in the usual manner, is removed from the main cylinder in the form of endless bands or slivers, by the condenser doffers, *i, k*, which are provided with rings of card and alternate blank spaces, so that the wool which is left upon the cylinder by the top doffer is removed by the lower one.

The stripper rollers, *l, m*, take these bands of wool from the doffers, after which they pass between the double endless twisting straps, *n, o*, for the purpose of receiving a degree of false twist or condensing, sufficient to enable them to carry forward to be spun.

They then pass between the delivering rollers, *p, q*, to the bobbins, *r, s*, on which they are lapped by friction of contact with the drums, *t, u*. When the bobbins are filled, they are removed direct to the mule to be spun, where they are turned off in a similar manner by drums.

The advantages of this system consist in a great economy of labour, three operations being dispensed with, viz., *feeding, piecing, and slubbing*, and in the yarns being more regular and level than those produced by the ordinary method.

In many of the first attempts to obtain endless cardings, the machines being fed by hand, the slubbings were not regular. The self-feeder has completely remedied this defect, and by its use a quantity of wool can be placed at the feeder of the second engine that will serve a day, or any smaller portion thereof.

An equal, and sometimes a greater quantity of work is turned off; the threads are more nappy, which increases the felting quality in milling, causes a firmer texture in the cloth, and a corresponding fulness of bottom and richness of appearance not attained by the methods formerly in use.

For warps, it is only necessary to double the slivers of wool upon an intermediate engine, and draw the slubbings more in the condenser and mule to obtain that straightness of fibre which gives strength to the thread.

Both machines are portable, readily applied to old engines, occupy no more room, and do not require short-time hands to work them.

The condenser is made with one, two, or three doffers, according to the quality of the work required; but each plan differs from any other in the superior manner of removing the wool from the doffer-cylinder by a stripper-roller, by which means the slubbings can be produced finer, so as to spin better, with less breakage and waste, both at the engine and mule. It also enables parties to work any description of wool without being confined to some particular kind that will suit the machine.

The one-doffer plans are intended for the coarsest work, and do not require any of the old parts of the engine to be removed.

The condenser, or endless carding system, reduces the operations to two of the simplest and most economical forms, viz.—*carding and spinning*. The failure of some methods intended to obtain a similar result, and the prejudice caused thereby against all, may be considered the causes of its not being universally adopted.

We are glad, however, to know that the merits of the system are fast becoming known, and meeting with that degree of extension that it assuredly deserves. Many of the machines are now at work in some of the most eminent manufacturing establishments, and giving great satisfaction.

AGRICULTURAL ENGINEERING.

(Continued from p. 190.)

Application of Liquid Manure.—As a pecuniary speculation, Mr. Mechi is quite satisfied with the result obtained from the application of liquid manure, but we may remind those of our readers who may pay a visit to Tiptree Hall, that a very different arrangement would be adopted were the engine and pumps constructed for the especial purpose. In the case before us the pumps are worked off cranks on a shaft at some distance from the engine, the power being conveyed by the existing mill shafting. In making a new engine for pumping, a preferable plan would be to connect the pump-plunger directly to the piston-rod, and make the pump double acting, as shown at p. 152, vol. 1851.

It will be useful to give an estimate of the cost of supplying a district, say of 1000 acres, which is furnished by Mr. W. Lee, C.E.

The district is supposed to be divided by imaginary lines into 25 squares of 40 acres each, in the centre of each of which is a stand pipe, a hose from which of 300 yards will reach the most distant point. Five lines of 3-inch cast-iron pipe are carried, parallel to each other, from the centre of the first to the centre of the fifth square, and at one end they are all united together by a row of five-inch pipe, from any convenient point of which a 6-inch pipe is carried to the engine-house. The estimate is as follows:—

	£	s.	d.
440 yds. 6-inch cast-iron pipe, jointed and laid, at 5*s.* 0*d.*	110	0	0
1,760 yds. 5 " " " " 4*s.* 0*d.*	352	0	0
4,400 yds. 4 " " " " 3*s.* 0*d.*	660	0	0
4,400 yds. 3 " " " " 2*s.* 4*d.*	513	6	8
25 hydrants and fixing, at 20*s.*	25	0	0
600 yds. of prepared canvas hose, making two sets, at 1*s.* 4*d.*	40	0	0
2 discharge pipes and spreaders, at 20*s.*	2	0	0
	£1,702	6	8

Cost of all the apparatus complete, £1 14*s.* $0\frac{1}{2}$*d.* per acre.

Annual charge on land, at $7\frac{1}{2}$ per cent., equal to 2*s.* $6\frac{1}{2}$*d.* per acre.

Iron pipes, 11 yards per acre.

The following table will surprise some of our readers who are not aware of the extent to which the system has been applied:—

Table, showing Cost, &c., of the application of Sewerage Waters and Liquid Manures.

Name of place.	No. of English acres.	Mode of application.	Cost of works and apparatus.	Annual interest, &c., at $7\frac{1}{2}$ per cent.	Annual working expenses.	Total annual charges per English acre.	Observations.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	
Edinburgh. Craigentinny Meadows: High Level	63	Steam-engine, pumps, and open gutters and panes	2,000 0 0	150 0 0	117 12 0	4 4 11	Average rental, upwards of £16 per English acre.
Sea Meadows	38	Gravitation, open gutters, and panes	700 0 0	52 10 0	19 17 6	1 18 1	Worthless 25 years ago, now worth about £520 per English acre.
Old Meadows	228	Gravitation, open gutters, and panes	2,700 0 0	202 10 0	119 5 0	1 8 $2\frac{1}{2}$	Maximum rental, £25 per English acre.
Nottinghamshire. The Duke of Portland. Clipstone Meadows	300	Catch-meadow, gravitation, and open gutters	36,000 0 0	2,700 0 0	150 0 0	9 10 0	Previously worth from 3*s* to 5*s.* per acre per annum, now worth upwards of £12.
Wiltshire. Wiley Meadows	150	Bed-work of ridge and furrow, gravitation and open gutters	3,000 0 0	225 0 0	52 10 0	1 17 0	Four heavy crops of grass per annum.
Devonshire. The Duke of Bedford. Tavistock Meadows	90	Bed-work and catch-meadow, gravitation and open gutters	1,183 0 0	88 14 6	67 10 0	1 14 $8\frac{1}{2}$	Land more than quadrupled in value after only four years' irrigation.
Berkshire. Philip Pusey, Esq., M.P. Pusey Meadows	100	Catch-meadow, gravitation, and open gutters	445 0 0	33 7 6	37 18 4	0 14 3	Land not previously worth more than 5*s.* per acre, is now yielding six heavy crops of grass per annum.
Glasgow. Mr. Harvey's farm	508	Steam-engine, pumps, underground iron main-pipes, and iron distributing pipes	1,450 0 0	108 15 0	240 10 0	0 13 9	10 feet thick of grass cut from an acre in six months.
Ayrshire. Myre Mill farm	508	Steam-engine, pumps, underground iron mains, gutta percha hose, and jet pipe	1,586 0 0	118 19 0	162 10 0	0 11 1	70 tons of grass cut from an acre in six months.
Canning Park farm	50	Ditto	210 0 0	15 15 0	11 0 0	0 10 $8\frac{1}{3}$	$14\frac{1}{4}$ feet thick of grass cut in seven months.
Leg or Dundaff farm	50	Gravitation, underground iron mains, gutta percha hose, and jet pipe	191 0 0	14 6 6	3 10 0	0 7 $1\frac{1}{2}$	12 stacks per annum previously; 80 stacks last year.
Staffordshire. The Duke of Sutherland. Hanchurch farm, near Trentham	83	Steam-engine, pumps, underground iron mains, gutta percha hose, and jet pipe	520 13 4	39 1 0	18 6 0	0 13 $9\frac{3}{4}$	Tanks constructed sufficient for 300 acres.
Lancashire. Halewood farm	120	Ditto.. Ditto	521 12 0	39 2 5	19 15 2	0 9 $9\frac{3}{4}$	One dressing of liquid, equal to 25 to 30 tons of farm-yard manure per acre.
Cheshire. Liscard farm	150	Ditto.. Ditto	672 1 10	50 8 0	17 11 0	0 9 $8\frac{3}{4}$	A fourth crop of grass being weighed was found equal to 10 tons per acre. It was the lightest crop cut off the same land.
Glamorganshire. Porth Kerry farm	50	Gravitation, underground iron mains, gutta percha hose, and jet pipe	300 0 0	22 10 0	10 0 0	0 13 0	Tanks constructed sufficient for 300 acres. Between 9 and 10 feet of grass cut.

THE LEWES SHOW OF THE ROYAL AGRICULTURAL SOCIETY.

We have not yet exhausted our notes of the articles exhibited at this show. Amongst the steam engines we must not omit to mention those of Messrs. Clayton, Shuttleworth and Co., which, for elegance of design, fitness of parts, and goodness of workmanship, deserve the highest commendation which it is in our power to give. This firm have laid themselves out for this work, and the result is, that they have sold 140 portable engines during the past year, a fact which speaks for itself.

Fig. 1 is a sketch of their 6-horse engine, which is of the following dimensions:—Cylinders $8\frac{1}{2}$ inches diameter by 12 inches stroke; crank shaft, $2\frac{3}{4}$ inches diameter. Fly wheel, which is turned to serve as a pulley, 5 feet diameter, and weighs 5 cwt., makes 115 revolutions per minute. Plates of boilers, $\frac{5}{16}$, tube plate, $\frac{3}{8}$ inch. Weight of engine, 55 cwt. (For duty, see p. 164).

Messrs. Clayton, Shuttleworth and Co., also exhibited a very neat horizontal engine, of which a sketch is subjoined, fig. 2. The slide is placed on the side of the cylinder, and the eccentric rod connected directly to it. The feed pump is worked off the cross head. An outer bearing is provided for the crank shaft by widening the sole plate at that end, which renders any other attachment to the building unnecessary. The dimensions of a 6-horse engine are as follows:—Cylinder, $7\frac{3}{4}$ inches diameter by 12 inches stroke; crank shaft, $2\frac{3}{4}$ diameter. Fly wheel 5 feet 6 inches diameter, and is turned to serve as a drum. Weight, 7 cwt. Makes 115 revolutions per minute.

The same firm also exhibited a small flour mill, fig. 3, which is very simple and effective. It consists of a pair of stones 2 feet 8 diameter, supported on a cast-iron column, the weight of which renders any other foundation unnecessary. The runner is adjusted by a very neat arrangement. The brass step of the spindle has a double thread on it, and can be turned a quarter round by being attached to a toothed segment, which is commanded by a worm and a small hand-wheel, shown outside the column. For the colonies such a mill would be invaluable.

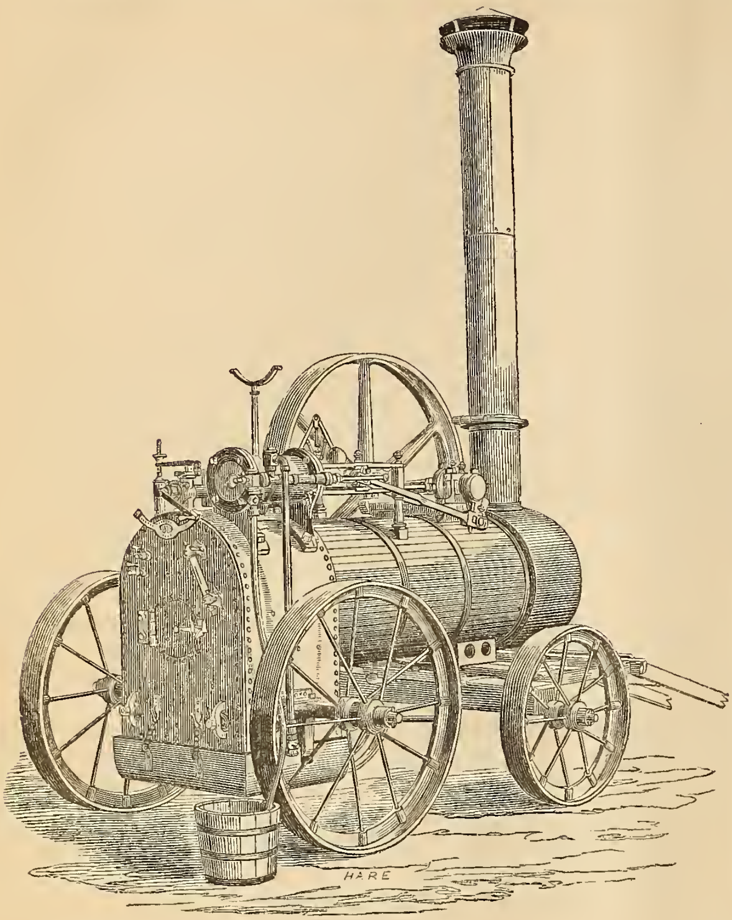


Fig. 1.

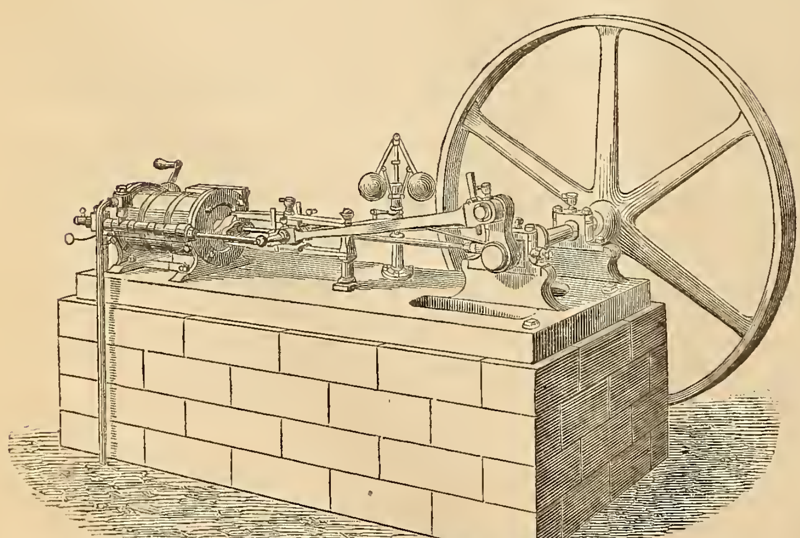


Fig. 2.

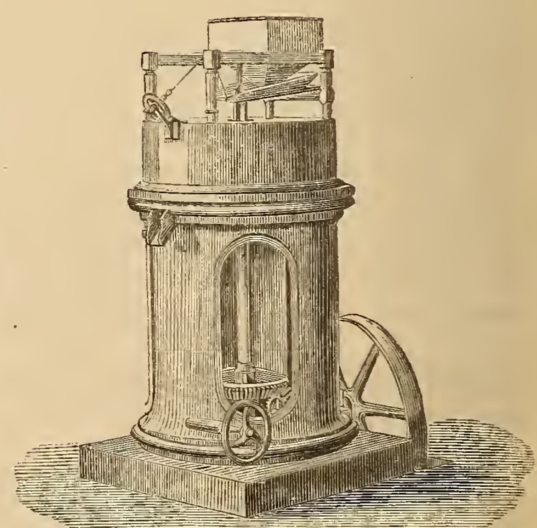


Fig 3.

ILLINGWORTH'S ADJUSTABLE ECCENTRIC.

It frequently happens that it is required to alter the position of an eccentric or cam on its shaft, either to vary the rate of expansion, or for any of the endless purposes to which cams are employed. For this purpose, Messrs. Illingworth and Sons, engineers, of Shipley, Yorkshire, have designed and registered a convenient method, represented in the accompanying engraving.

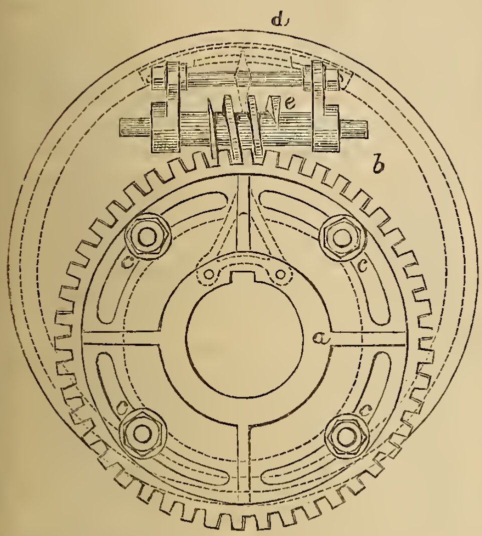


Fig. 1.

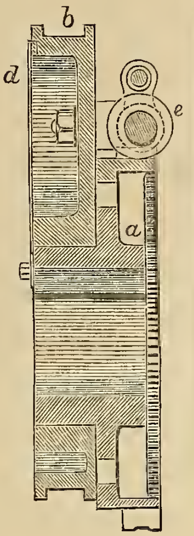


Fig. 2.

Fig. 1 is a side elevation, and fig. 2 a transverse section, of the eccentric.

The worm-wheel, *a*, is keyed on the crank shaft of the engine, and the boss is prolonged to form a seat for the eccentric, *b*, the latter being free to revolve, and being held in contact with the worm-wheel by the four bolts, *c, c, c, c*. Motion is given to the eccentric by the worm, *e*, whilst the relative position of the eccentric and wheel is indicated by a pointer, *d*, fixed to the latter, which remains stationary, whilst a scale attached to the eccentric moves past it.

ON THE COMPARATIVE ECONOMY OF CONDENSING AND NON-CONDENSING ENGINES.*

That steam may be used in an ordinary non-condensing engine, of such an elasticity as shall make it fully equal in economy of fuel to the low-pressure condensing engine commonly employed in English practice, has long been believed by many engineers, both scientific and practical, to be a point that can be easily proved.

The writer records his own adherence to this belief, notwithstanding it involves a supposed law upon the pressure and density of steam greatly at variance with the opinions of several eminent writers upon the steam-engine. Thus, according to Dr. Lardner, from whom we take the following extract, it would seem to be immaterial in what manner, or in what kind of engine, steam is used, and that all experiments and research to determine in what way to realise the greatest mechanical effect therefrom has been entirely useless.

"The same quantity of water being converted into steam, produces the same mechanical effect, whatever be the *pressure* or *density* of the steam."—*Dr. Lardner on the Steam-Engine, p.* 279, *American edition.*

But the opinions of this author are sometimes fallible; witness his arguments respecting the practicability of establishing a regular communication, by the power of steam, between Great Britain and the United States, which have been proved erroneous by more than two years' experience; and we shall venture to assert that he greatly errs in the above statement, appealing, as we confidently can, to the experience of almost every practical engineer to sustain the assertion.*

To return, however, to that particular application of steam which is most immediately the subject of this paper. We shall endeavour to show that there *is* a pressure at which, if a non-condensing engine be worked, it will, for a given mechanical effect, equal in economy in the consumption of fuel the low pressure condensing engine of the English practice, and that this pressure is safely and with certainty attainable.

In treating of the density and pressure of steam relatively to each other, the subject has become so mystified and obscured by the contradictory statements of different authors, that the practical engineer is at a loss in what manner to understand the ratio of increase, or what reason to assign for it. That this is the case is shown by the extracts which follow, taken from the works of several writers upon the steam-engine.

"And they also show that the bulk or volume of steam is *inversely as the pressure*, when the temperature is not altered; and conversely the *density is directly as the pressure*."—*Vide Tredgold, Woodhouse's edition, p.* 52.

"That the bulk which steam fills is diminished in the same proportion as the pressure of the steam is increased; or, in other words, that the *density* of steam is always in the *same proportion* as its *pressure*."—*Lardner upon the Steam-Engine, p.* 279, *American edition.*

"It may likewise be remarked, that the variation of the density or specific gravity of steam is only *strictly proportional* to its pressure or elasticity when the temperatures are the same."—*R. Wallace's Practical Mechanic's Pocket Guide, p.* 43.

"This arises from the fact that the density of steam increases *nearly* as fast as the pressure nder which it is generated. Did both increase in the *same* ratio, there would be nothing gained by the use of high steam."—*Renwick on the Steam-Engine, p.* 162, *new edition.*

In addition to this last extract, we append the following, taken from the same work, which directly contradicts it:—

"It is a law which holds good in *all* elastic fluids, that they occupy spaces which are inversely as the pressures to which they are subjected, and their densities are in consequence in the *direct ratio* of the pressures."—*Renwick on the Steam-Engine, p.* 14, *new edition.*

But in order, if possible, to confuse the student or engineer still more, there is given in almost all of the works from which the extracts are taken, tables, showing the number of volumes of steam for a given pressure compared to the volume of water that produced it, and consequently showing that the density *does not* increase in the same ratio as the pressure.

By the term density, used in the foregoing extracts, is understood the specific gravity of steam, and it will be seen by examining them that the fourth extract directly contradicts all the others; yet, notwithstanding this large majority against it, we have no hesitation in saying that it is correct.

We shall now endeavour to show *why* the non-condensing engine, working at some given pressure, *is* equal in point of economy of fuel to the low-pressure condensing-engine. This we conceive to be attributable to two distinct parts of the operation:—

1. The greater economy of fuel in the generation of steam of a high pressure compared with that of a lower one.

2. The economy arising from the superior effect produced by the steam, when used at a high-pressure, to that when used at a lower one.

In order to show that the above-mentioned causes are those to which the asserted economy in the use of high-pressure steam is due, it will

* This article has already appeared in an American Journal, but, we believe, is now, for the first time, published in this country. It is attributed to the pen of Mr. C. W. Copeland.—Ed. *Artizan.*

* For a correction of this misapprehension of what Dr. Lardner really did say, see *Artizan*, 1851, p. 257.

be necessary to introduce the following table, showing some of the properties of steam; the three first columns of which are extracted from a similar one published in Pambour's Theory of the Steam-Engine; the fourth column is calculated from the comparative volumes of steam to the volume of water that produced it; and the fifth is calculated from the fourth. Similar tables containing the first three columns can be found in almost every scientific treatise upon the steam-engine: this is selected merely from the fact of its being more complete than most of them.

In this table we have made a total pressure of 15 lbs. per square inch our starting point, and throughout this article we shall consider it equal to the pressure of the atmosphere, although, strictly speaking, it is a fraction greater; but it is sufficiently correct for our purpose.

By examining the following table, it will be seen that, whenever the pressure is doubled, the density, as given in the fourth column, falls greatly short of it. For instance, at 15 lbs. pressure the density is represented by 100; and at 30 lbs. or double the pressure, the density is but 189.

Total pressure in lbs. per square inch.	Corresponding Temperature by Fahrenheit's Thermometer.	Volume of steam compared to the volume of water that produced it.	Rel. dens. of the steam—that at 15 lbs. or the pressure of the atmosph. being called 100.	Pressure of the steam if only in a direct ratio of the densities—in lbs.
15	213·0	1669	100	15·0
20	228·3	1280	130	19·5
25	240·7	1042	160	24·0
30	251·2	882	189	28·3
35	260·3	765	218	32·7
40	268·4	677	246	36·9
45	275·7	608	274	41·1
50	282·3	552	302	45·3
55	288·4	506	330	49·5
60	294·1	467	357	53·5
65	299·1	434	384	57·6
70	304·2	406	411	61·6
75	308·9	381	438	65·7
80	313·5	359	465	69·7
85	317·8	340	491	73·6
90	321·9	323	516	77·4
95	325·8	307	544	81·6
100	329·6	293	569	85·3

Again, at 40 lbs. pressure the density is 246; but at 80 lbs. or, double the pressure, it is but 465.

And again, at 50 lbs. pressure the density is 302; but at 100 lbs., or double the pressure, it is but 569.

By referring to the fifth column, which represents the pressures that the steam should be equal to, provided the law given in the majority of the extracts quoted in the first part of this paper was correct—viz., "that the density is directly proportional to the pressure,"—we find a great discrepancy between these and the actual pressures. For instance, at a temperature of 251·2 degrees, the pressure is stated in the first column at 30 lbs.; but by running the eye across to the fifth column, we find, if this law be correct, that the pressure should be only 28·3 lbs.

Again, at a temperature of 329·6 degrees, the pressure, as given in the first column, is 100 lbs.; but by examining the fifth column, it appears that the pressure, to be strictly proportional to the density, should be only 85·3 lbs. The numbers in this column also show the relative amounts of fuel required to maintain the steam at the pressures given in the first column.

Now let us examine whether or not the numbers given in the fourth and fifth columns are correct; and in order to do this it will be necessary to institute a comparison between the first and third columns. In so doing, it will be found that the volumes of steam (as compared with the volume of water which produced them) are not precisely in an inverse ratio to the pressure; but that, when the pressure is doubled, the volumes of steam are greater than one-half of the number at the former pressure. As an instance, take 15 lbs. pressure in the first column, the corresponding volumes of steam in the third column are 1669; now, at double the pressure, or 30 lbs., the volumes of steam are 882, being about 47 volumes greater than one-half the number of volumes at 15 lbs. pressure. As another instance, take 50 lbs. pressure: the corresponding volumes of steam are 552; but at double the pressure, or 100 lbs., the volumes are 293, or 17 volumes greater than one-half.

The volumes of steam proportional to the water which produced them, and also the temperature of steam at different pressures, as given in the foregoing table, have been proved correct by numerous experiments, and implicit reliance may be placed upon their accuracy. Now, as the fourth and fifth columns are calculated from the column of the volumes of steam, we think the whole table may be considered correct.

It is necessary to be thus particular in showing the accuracy of the foregoing table, as the whole of the following chain of reasoning, which is to show the cause of the asserted economy of high-pressure engines, is dependent thereon for its value; therefore, if the table be inaccurate, the whole must be fallacious.

It has been satisfactorily ascertained, by numerous well-conducted and accurate experiments, that any given amount of fuel will convert a certain quantity of water into steam, without regard to the pressure under which it is evaporated; or, in other words, the same amount of fuel that will evaporate a cubic foot of water, under a pressure of steam equal to one atmosphere, would evaporate the same quantity, were the pressure of steam equal to five or ten atmospheres.

It follows from this, that the amount of fuel required to generate steam of different pressures is in the direct ratio of their densities; therefore, if we represent the quantity or weight of fuel required to generate a cubic foot of steam of a total pressure of 15 lbs., or one atmosphere, by 100, the fourth column of the table, or the column of relative densities, will show the relative amount of fuel required to generate a cubic foot of steam of any other pressure given in it.

We shall see, by reference to the table, that allowing 100 parts of fuel to be required to generate a cubic foot of steam of 15 lbs. pressure, but 189 instead of 200 parts are required to generate the same bulk of steam of 30 lbs. pressure; and but 357 instead of 400 parts are required to generate the same bulk of 60 lbs. pressure.

It follows, therefore, that the pressure and mechanical efficiency of steam increase in a greater ratio than the consumption of fuel; consequently, we may arrive at so great a pressure, in the use of steam in non-condensing engines, as that the advantage gained in this manner shall equal in effect that acquired by condensing the steam in a low-pressure engine.

We conceive that we have thus established the truth of the first reason assigned by us for the economy of high-pressure non-condensing engines, viz., "the greater economy of fuel in the generation of steam of high-pressure compared with that of a lower one."

After having examined the foregoing table, and followed out the chain of reasoning here presented, the question naturally arises, *Why* the pressure of steam increases in a greater ratio than the density?

We will now endeavour to explain as clearly as possible what we apprehend to be the cause.

Suppose a boiler to be charged with water and steam, in a similar manner to a boiler in ordinary use, at a pressure of 15 lbs., and consequently at a temperature of 213 degrees, and the pressure is increased to 40 lbs., the temperature is consequently raised to 268·4 degrees, or an addition of 55·4 degrees. By reference to the fifth column of the table, it will appear that, had the pressure increased only in the same ratio as the density, it would be but 36·9 lbs. instead of 40 lbs., the difference, or 3·1 lbs. remains to be accounted for.

(To be continued.)

IMPROVED SAFETY VALVE AND WATER INDICATOR.

Messrs. Dangerfield and Bennett, of West Bromwich, have lately registered an improved form of safety valve and water indicator,

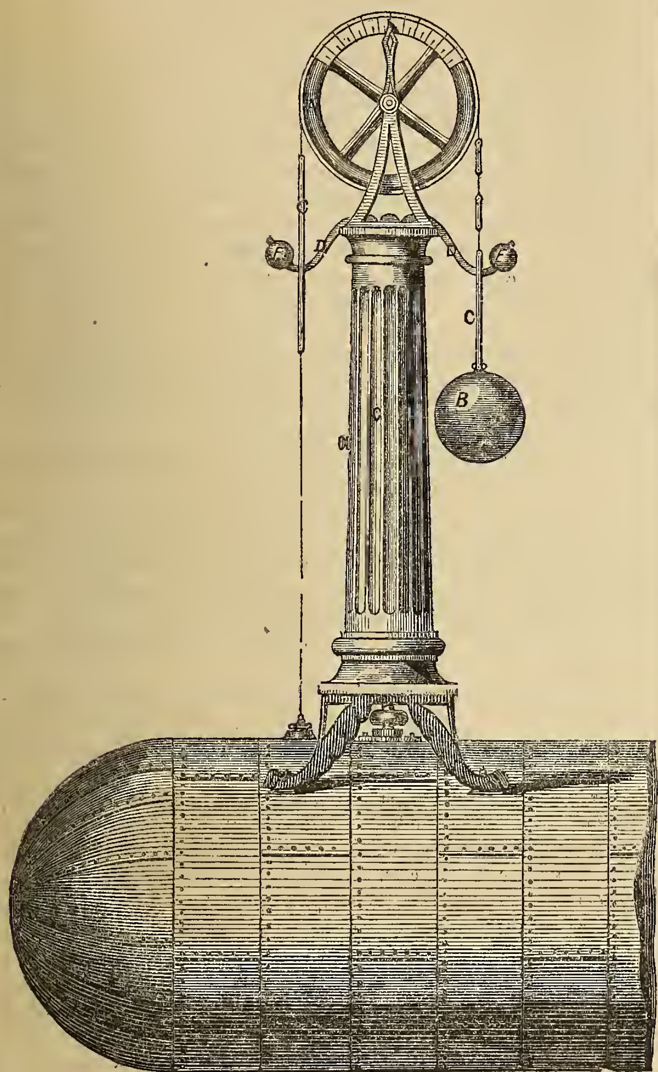


Fig. 1.

which also forms a lock-up valve and alarm whistle, arranged in a convenient form.

Fig. 1 is an outside elevation, and fig. 2 the same in section. A float is placed within the boiler, and connected, in the usual manner, by means of a wire, to a band passing over the pulley A, the weight of the float being balanced by the weight B. At each end of the band is a long link, C C, taking on to two levers, D D, which move on centres attached to the column G. The inner ends of these levers take into a slot in the spindle of the safety valve, so that if the float and the links move, the safety valve is lifted, and the steam escaping strikes a bell, E, and gives audible warning, whilst the actual level of the water in the boiler is observed from the position of the wheel in regard to the index. Thus the alarm is given when the water is either too low or too high in the boiler; but to prevent slight fluctuations in the water-level having this effect, the links, D D, have slots in them, which admit of a certain range of motion, without acting on the valve.

The weights of the levers, D D, are balanced by the weights, F F.

The weights by which the safety valve is loaded are entirely enclosed within the column, G, which has a door in the side, by locking which, any tampering with the weights is prevented.

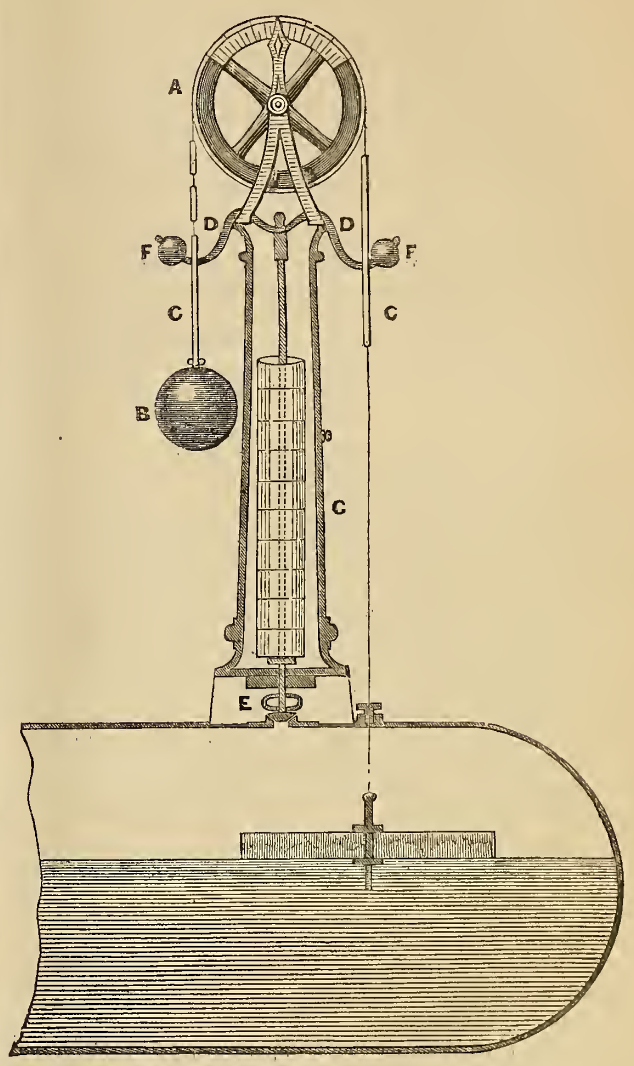


Fig. 2.

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS.

28th April, 1852.

A supplementary paper by Mr. J. Samuel was read, in continuation of the paper on his *continuous expansion steam-engine*, reported at p. 53.

In the discussion on this paper, Mr. Samuel explained that the diagrams (p. 53) were not actual indicator diagrams, but theoretical ones, as he had not had an opportunity of completing his experiments. As far as they went, however, they showed that the blast could be reduced without impairing the efficiency of the engine. In a goods engine of the largest size, on the Eastern Counties, the valves were altered, but the cylinders were retained both of the same size, and the result was a saving of 12 lbs. of coke per mile. In a passenger engine, the low-pressure cylinder was made double the area of the high-pressure one, and it was never found short of steam, though running with express trains of considerable weight, for a month's regular work.

The chairman (Robert Stephenson) said there was one circumstance which

did not appear correct in theory. In other double-cylinder engines the first piston is allowed to complete its stroke before the steam is expanded into the second cylinder; but in this engine the steam is passed into the second cylinder at the middle of the stroke of the first piston, thereby taking the steam away at the very moment that it is most efficient in the small cylinder.

Mr. Samuel explained that at the half-stroke of the first piston the second piston was at its dead point, and began to move very slowly, when the communication was opened between the two cylinders, and consequently took very little steam, whilst the first piston moved through the greater portion of its remaining stroke; but then, as the first piston was getting less effective, and approached its dead point, the second piston came gradually into full action, making a *continuous* expansive action, which was the peculiar feature of this engine, instead of the *intermittent* expansion of other double-cylinder engines.

Mr. Slate thought there would be a greater loss from the resistance of the atmosphere. If the steam were employed at full pressure, say 90lbs., in the small cylinder alone, the atmospheric resistance would only cause a deduction of $\frac{1}{7}$ of the whole power; but if the steam were only about 30lbs. pressure in the large cylinder, the deduction for the atmospheric resistance would be increased to $\frac{1}{3}$ of the power. Therefore it appeared most advantageous to employ the steam only in the small cylinder, to diminish the proportion of atmospheric resistance as much as possible.

A paper by Mr. J. Wilson, of Bridgewater Works, St. Helen's, was then read:—*On a new mode of measuring high temperatures.*

The author first noticed the existing plans in use for measuring high temperatures.—1. Wedgwood's pyrometer, which depends on the contraction of clay at high temperatures, which has the disadvantage of requiring a fresh piece of clay for every experiment, and the experimenter is thus never sure that the contraction of any two pieces will be uniform.—2. Daniell's pyrometer, consisting of an iron or platinum bar, encased in blacklead or earthenware, the expansion of which is measured by an index. The objection to this method is the extreme delicacy required in its manipulation, which renders it inapplicable for ordinary purposes.—3. The air pyrometer, which consists of a globe of platinum containing air, the quantity of which driven out by the heat is measured by collecting it over water.

The following is the method employed by the author:—Take a given weight of *platinum*, and expose it for a few minutes to the fire, the temperature of which is to be measured, and then plunge it into a vessel containing *water* of a determined weight and temperature, and after the heat has been communicated to the water by the heated platinum, mark the temperature which the water has attained, and from this is estimated the temperature to which the platinum had been subjected. Thus, if the piece of platinum employed be 1,000 grains, and the water 2,000 grains, and temperature 60°, should the heated platinum, when dropped into the water, raise its temperature to 90°, then $90°—60°= 30°$, which, multiplied by 2 (because the water is twice the weight of the platinum), gives 60°, to which an equal degree of water would have been raised. To convert the degrees of this instrument into the degrees Fah., we must multiply by 31·25. Thus, $60° \times 31·25 = 1875°$

The multiplier 31·25 is the number expressing the *specific heat* of water as compared with that of platinum, the latter being regarded as 1.

To guard against the loss of heat by radiation and conduction, the vessel containing the water, about 2 inches diameter and 3 inches deep, is of polished tinned iron, and is enclosed in a jacket. In lifting the piece of platinum, a pair of tongs, heated to redness, is employed, which prevents any abstraction of heat. A correction has to be made for the glass and mercury of the thermometer, the iron vessel containing the water, and the heat retained by the platinum, which, with average dimensions, raises the multiplier from 31·25 to 33.

As the platinum is expensive, it is proposed to use pieces of baked Stourbridge clay, not more than $\frac{1}{2}$-inch cube, to ensure their being uniformly heated.

A paper by Mr. D. K. Clark, of Edinburgh, was then read:—*On the expansive working of steam in locomotives.**

The practical economy of expansion in locomotives has been doubted, and the object of the present paper is to discuss this question in all its bearings.

On the *theoretical* economy of expansion there can be no doubt, but it necessitates a reduction of power of the engine, by the reduction of the mean pressure on the piston. But this is merely saying that the cylinder is not of sufficient capacity. The cooling effect of the atmosphere is also more felt when working expansively, and especially when the cylinders are imperfectly protected. The remedies for these defects are obvious. The enlargement of the cylinder to make up for the reduction of pressure, and the more perfect clothing of them to prevent condensation. But, in fact, the using less steam per stroke will admit of a higher initial pressure being obtained in the cylinder, and the steam thus expanded will give nearly the same average pressure as if wire-drawn in the ordinary way.

Can the steam be worked expansively to advantage with the link motion? The way in which the valve is caused to cut off the steam earlier, by the link motion, is by shortening the travel of the valve. This is accomplished by the reversing gear in such a manner that, whatever be the reduction of travel communicated to the valve, the lead is always at least the same as in full gear, and with the shifting link is rather increased. In shortening the travel, not only is the steam cut off at an earlier point of the stroke, it is also exhausted earlier, and admitted earlier, and the exhaust port is closed earlier, during the return stroke, upon the exhaust steam.

1. Thus, by shortening the travel, everything affecting the distribution is done earlier in the course of the steam and return strokes.

2. But, though every change is made earlier—as measured in parts of the stroke—there is less difference in the position of the points of exhaust, compression, and admission than in that of the cutting off; consequently, the shorter the admission, the longer is the expansion, as the exhaust point does not recede so much as the point of cutting off.

3. By the shifting link motion, the steam may be cut off at from $\frac{1}{6}$ to $\frac{1}{7}$ of the stroke.

4. Although the exhaust does take place earlier for every increase of expansion, it does not, in any case, take place within the first half of the stroke. For mid-gear it occurs, in fact, at 54 per cent. of the stroke; and the steam is expanded into $3\frac{1}{2}$ times the length of stroke at which it is cut off.

5. The period of compression increasing as the admission is reduced, amounts to about one-half stroke in mid-gear.

6. The pre-admission of steam, not above 1 per cent. of the stroke in full gear, reaches about 10 per cent. in mid-gear. These results are with an ordinary shifting link-motion, in every modification of which the lead increases with the expansion, and in the case quoted rises from $\frac{5}{16}$ to $\frac{9}{16}$ inch in mid-gear. Whereas, in stationary link motions, having the link suspended directly from a fixed point, the lead is constant for all degrees of expansion, and if in these the lead be set at $\frac{1}{4}$ to $\frac{5}{16}$ constant, we should be able to cut off at $\frac{1}{10}$ or $\frac{1}{8}$ of the stroke.

The objections which are brought against this system of working are:—

1st. That there is a serious loss of steam from premature exhaustion. Indicator diagrams, taken by Mr. Daniel Gooch, from the *Great Britain*, G. W. R., show that at high speeds it is not above 1lb. per inch, whilst the greatest loss, at low speeds, is only 3lbs. This supposed loss is, in reality, a gain, because an early exhaust is essential, at high speeds, to the perfection of the exhaust during the return-stroke.

2nd. That the steam is wire-drawn when under great expansion. From the diagrams it is evident that this takes place to a small extent at high speeds; but the mean loss, even with high expansion, is only 1lb. per square inch on the stroke. But it must be remembered that, in this case, the ports are of unusually liberal dimensions, viz., $\frac{1}{10}$ the area of the cylinder—a proportion which it is necessary to attain to ensure good results.

3rd. That a large proportion of the power is lost by the compression of the exhaust steam. "Compression, however, involves no loss of efficiency; for as by compression a quantity of steam is incidentally reserved and raised to a higher pressure, it gives out the power so expended in compressing it, during the next steam-stroke, just as a compressed spring would do in the recoil." But, apart from this general argument, the actual efficiency of the steam in the cylinder, with and without compression, may be exactly estimated, by comparing the quantities of water evaporated with the mean effective pressures.

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* We regret that we are precluded by its length from giving this valuable paper *verbatim*, but we have endeavoured to place the conclusions which the author has arrived at, in a condensed form, before our readers.

The effect of compression on the diagram is shown at fig. 7, p. 269, *Artizan*, 1851; and, from a similar diagram, it is shown that the effective pressure created per cubic inch of water is, in actual practice, 7·1lbs.; and would be, by removing the compression, 6·9lbs.; figures so nearly identical, as to show, "that the resistance by compression in the cylinder, due to the action of the link-motion, does not, in the slightest degree, impair the efficiency of the steam."

5th. That at *high speeds* considerable *back exhaust pressure* is created. This is not the fault of the link-motion, but of small ports, deficiency of inside lead (which is regulated by the lap), a small blast orifice, and imperfect protection of the cylinder. A small blast pipe may be necessitated by a small boiler, but the diagram referred to shows what may be accomplished by adopting good proportions. With the *Great Britain*, running at 55 miles per hour, the per-centages of back pressure, in terms of the positive mean pressure, are, at 1st notch, $8\frac{3}{8}$ per cent.; 3rd notch, $5\frac{3}{4}$ per cent.; and 5th notch, nothing. This is all that can be desired, since locomotives, adapted to their work and running at high speeds, should not expand less than half-stroke.

The author then gives an elaborate table deduced from the diagrams, showing the effect obtained with different rates of expansion, which may be expressed by the consumption of coke or water per horse power per hour:—

For the 1st notch 28·3lbs. water, or 3·54lbs. coke.
" 3rd " 24·3lbs. " " 3·03lbs. "
" 5th " 20·1lbs. " " 2·51lbs. "

STATE OF THE VALVES OF THE "GREAT BRITAIN" G. W. R.

Cylinder, 18 inches × 24 inches; steam ports, 13 inches × 2 inches, or $\frac{1}{10}$ area of cylinder; blast orifice, $5\frac{1}{2}$ inches diameter, or $\frac{1}{11}$ area of cylinder; lap, $1\frac{1}{4}$ inch; constant lead, $\frac{3}{8}$ inch; travel of slide in full gear, $4\frac{3}{4}$ inches; wheel, 8 feet diameter.

No. of Notch.	Position of Points of Distribution.			Period of exhaust during the Steam Stroke.
	Cutting off.	Exhaust.	Compression.	
	Inches of Stroke.	Inches of Stroke.	Inches of Stroke.	Inches of Stroke.
1	16	$21\frac{3}{8}$	3	$2\frac{5}{8}$
3	$11\frac{3}{4}$	$19\frac{3}{4}$	5	$4\frac{1}{4}$
5	7	$17\frac{3}{8}$	$7\frac{1}{2}$	$6\frac{5}{8}$

The author gives a remarkable result of the difference of working with the link motion and the fixed gab-motion, which was tried on the *Europe*, on the Edinburgh and Glasgow Railway. The consumption of coke showed a saving of 30 per cent. in favour of the link, from the means which it affords of working expansively, and the consumption of water showed a similar result.

In the discussion which ensued, Mr. Clarke said that, in the *Great Britain* locomotive, the steam-pipe was carried straight down in front of the tubes, instead of being curved on one side as usual, and being of $\frac{1}{8}$-inch copper, the heat from the tubes was rapidly communicated through it, and the steam became much heated.* "It had been found that there was considerably less difference between the pressure of the steam in the boiler and that in the cylinder, than was the case in other engines where the steam did not get so much heated; and Mr. Gooch had found, in repeated experiments, very carefully tried, that the pressure was actually a little higher in the *steam-chest* than in the boiler,"† the difference being greater at a higher speed, and amounting to as much as 7 to 10 lbs. per inch in some cases, the pressure in the cylinder being equal to that in the boiler, and in some cases 2 or 3 lbs. above, instead of being considerably below, as was the case in most engines in regular work. He could only suppose that the elastic force of the steam was increased by its becoming surcharged with heat in the smoke-box after leaving the boiler, but could not account for a greater pressure being apparently maintained in the valve-chest whilst the steam was flowing into it from the boiler.

The Chairman said that Mr. Trevithick had found that one bushel of coals burnt in heating the cylinder by a flue carried round it, was as efficacious as 5 bushels burnt under the boiler.

At a special general meeting held in London, 29th June, 1852, J. E. M'Connell, in the chair,

Mr. Clark read a continuation of his paper, in which the condensation which takes place in outside, or unprotected cylinders, was considered. It was shown that, in the "Great Britain," no condensation took place, whilst in engines on the Caledonian Railway, a considerable loss was sustained both by condensation and by the presence of water in the cylinders, the latter causing a large increase in back pressure. To show that the presence of water was due to condensation and not to priming, it was noted that the water in the cylinders was most when the steam used was least in quantity. It is this loss which has led many persons to deny the economy of working expansively in locomotives, but it is clearly attributable to the exposure of the cylinders.

Another collateral proof was found in the proportions of inside lead, which outside cylinders require, to afford a sufficiently free exhaust. As inside lead is equal to the sum of the lap and the outside lead, and is, in fact, regulated by the lap, it has been found that in Sharp's inside-cylinder engines, on the Edinburgh and Glasgow Railway, which have only a $\frac{5}{8}$-inch lap—probably the shortest lap in present practice for a 15-inch cylinder—the exhaust is as perfect as in the Caledonian passenger engines with $1\frac{1}{2}$-inch lap for the same cylinder. In outside cylinders it is important to keep the valve gear in the highest order, as the wear of the gearing directly reduces the lead, and thereby increases the back pressure. In existing engines more lap can be given, and the admission kept as before, by lengthening the link beyond the eccentric-rod ends.

Conditions on which the expansive working of steam in locomotives may be carried out with efficiency and success.—The first condition is to perfectly protect the cylinders, and to maintain them at a *temperature at least as high as that of the steam admitted to them.* Simple non-conducting envelopes are not sufficient; external supplies of heat must be employed, and the application of a steam-jacket to the cylinder would be advantageous, when other sources of heat are not readily available. The author tried an experiment with the "Orion," Edinburgh and Glasgow Railway, which has its cylinders suspended in the smoke-box, like the "Great Britain's," in which, by the use of partitions, the hot air from the tubes was directed entirely round the cylinders, previously to its emerging by the chimney; but he could not detect the slightest change in the performance of the engine, probably because the hot air was really very little hotter than the steam, and the closer contact made no difference. For cylinders already well protected, more thorough modifications would be required to make a sensible improvement. The steam should also be surcharged previously to entering the cylinder, by passing over an extensive heating surface, deriving its heat from the atmosphere of the smoke-box, or, if necessary, from a hotter source.

The author has lately been favoured with the results of experiments made by Mr. W. C. Hare, of Stonehouse, Devon, on a small engine, with cylinder $3\frac{1}{2}$ × 8 inch stroke, and a boiler having 9 feet of heating surface. He employed a special coil of 40 feet of half-inch copper tube, having $5\frac{1}{4}$ feet of inside surface, and heated by a circular row of very small gas jets. A small cock was fixed on the top of the boiler, close to the mouth of the steam-pipe, and by occasionally opening it when the engine was working, any priming, or even mere dampness of the steam, could be detected; and thus the experiments could be conducted with the assurance that the results were not affected by priming. When the steam was passed through this surcharging pipe, and was heated to 400° previously to its entering the cylinder, the consumption of water from the boiler was three gallons per hour; and when the communication with the surcharging pipe was cut off, and the steam led directly to the cylinder, the water used amounted to six gallons, or twice the other, while doing the same work, and involved a great increase

* I have made some experiments on steam heated by passing it through a large coil at a red heat, and from the slight effect produced upon even a small quantity of steam, I am not inclined to lay much stress on the position of the steam-pipe, because the amount of surface and the temperature are insignificant when compared with the large volume of steam passing through the pipe. Mr. Hare's experiment, hereafter mentioned, seems also to confirm this impression.—W. K. W.

† This astounding statement made us rub our eyes to see where the defect lay, and it was only a consideration of the context which led us to conclude that *valve-chest* was meant. We have often experienced the want of an engineering dictionary, but we never before had our faith shaken in the legitimate meaning of the word "steam-chest,"—*a reservoir of steam attached to a boiler.*

of fuel consumed. To effect the economy here noted, from which something must be allowed for the consumption of gas, it appears that a surcharged surface equally to fully one-half of the heating surface has been necessary; and it is probable that for locomotives a considerable allowance must be made to produce a very decided change. The results of this experiment show that very much has yet to be done before the capabilities of the locomotive are fully developed.

As steam has been found so very sensitive to *exposure* on the one hand, and to *surcharging* on the other, it would probably be of advantage to *lead the hot smoke round the barrel of the boiler and the fire-box*, or the barrel only, *previously to its discharge by the chimney*.* The barrel only would probably be enough to tell with good effect, and the hot air might be led either in a winding flue round the boiler, or, what would be better, led along the entire lower half towards the fire-box, and returned along the entire upper half to the chimney. If *all* the hot air were found too much, only a *part* of it might be diverted by partitions, or otherwise, from the upper or lower tubes.

The second condition of successful expansive working in locomotives is the combination of a sufficiently high boiler-pressure of steam, with suitable proportions of cylinder and driving wheel, to admit of highly expansive working consistent with the required duty of the engine. It is probable that 150 lbs. per inch is about the highest pressure at which it is advisable to work a locomotive, consistent with the fair working and durability of its parts. The maximum pressure being settled, and it being assumed that the same pressure is to be maintained in the cylinder during admission, the degree of expansion to be adopted determines the capacity of the cylinder to develope the necessary average power. Long strokes are not advisable on the score of stability, at least for outside cylinders, and large diameters should rather be adopted; for the same reason, large wheels are preferable.

Thirdly, in the details of the mechanism, the cylinder should be arranged to have the shortest practicable steam-ways; as, for short admissions, a long steam-way deducts very much from the efficiency of the steam. Such an arrangement would be greatly promoted by the introduction of balanced valves, or such as have provision for preventing the steam-pressure on the back of the valve; as, by being balanced, they could with facility be made large enough to embrace the whole length of the cylinder. The loads which ordinary valves are forced to carry on their backs are enormous; and though there is certainly no momentum in these loads to contend with, yet the friction of surfaces due to the loads is very great, even at the most moderate computation.†

Mr. Crampton inquired whether it was intended in the paper that outside cylinders could not be effectually protected? He was aware there was a strong opinion amongst engineers that outside cylinders could not be properly protected, but he considered there was no impossibility in it.

Mr. Clark replied, it was only intended to be stated in the paper that the general effect in practice was, that outside cylinders were worse protected than inside cylinders, and they were generally very much exposed.

Mr. Crampton thought that enough attention had certainly not been paid to the condensation in the cylinders of locomotives at slow speed; he did not think it was of so much importance at high speeds. It was also particularly of importance in steam-boat engines, where the question had not received so much attention as it deserved. He remembered an experiment which showed a remarkable effect of condensation: four condensing engines, of equal size, were working coupled together in a boat, with the steam cut off at one-quarter of the stroke and expanded; two of the engines were then disconnected, and the other two engines were worked, cutting off at half-stroke, using, consequently, the same quantity of steam as the four engines did, cutting off at one-quarter of the stroke; but a greater effect was found to be produced by the steam than when it was used in the four cylinders. This increase of effect appeared to be entirely due to the greater amount of condensation that took place in the four cylinders than in the two cylinders. There were no steam jackets, only ordinary clothing on the cylinders, and he thought much improvement was required in this respect in marine engines, and it was a matter well deserving the consideration of engineers.

In reply to an inquiry, he said the boilers were working with salt water, but he did not think that would affect the result.

Mr. Clark said he had found that even at the highest speed in locomotives there was great condensation with high degrees of expansion, except in the case of well-protected inside cylinders.

Mr. Peacock suggested, that part of the effect in the experiment mentioned by Mr. Crampton might have been due to the smaller amount of friction in the two cylinders than in the four cylinders, when giving out the same total amount of power.

Mr. Crampton replied, that a greater effect was found to be produced after allowance was made for the friction, by taking indicator-diagrams, and the relative consumption of the water.

Mr. Whytehead thought the per-centage of loss by back pressure would also be less in the case of the two cylinders than with the four.

Mr. Bovill inquired whether Mr. Crampton could give the result of any trials of the relative consumption of steam, with unprotected cylinders, and with steam jackets?

Mr. Crampton replied that he could not give the exact comparison.

Mr. E. A. Cowper exhibited an indicator-diagram, which he had obtained from a 35-horse-power stationary engine, cutting off at about $\frac{1}{4}$-stroke, and working expansively, on which he had drawn the true expansion curve, according to Pambour; the difference between the actual and the theoretical curve was a confirmation of Mr. Clark's observations, the actual curve having fallen below the theoretical at the commencement, and gradually risen a little above it at the latter part of the expansion, from the temperature of the cylinder being higher at that time than the steam. The engine had an uncovered cylinder without a steam jacket, but was not exposed to the cooling action of passing rapidly through the air like a locomotive cylinder.

THE FREEHOLD LAND SOCIETIES' QUESTION.

The great number of Freehold Land Societies that have been established during the present year, and the circumstance of *Conservative Land Societies* having been formed, as well as *Free-trade* and *Liberal* institutions, induces us to bring before our readers the views of Mr. Scratchley, the authority on *Benefit Building Societies*, in his book,* on the general principles of association for land investment, exemplified in the case of freehold land societies, &c.

"In every land investment society," observes Mr. Scratchley, "there are usually the two classes, as in the benefit building societies, who have in view different objects, which, diversified perhaps in their smaller details, form the basis of each association."

Among the candidates for attention stand first in importance numerous institutions which have recently come into existence under the name of "Freehold Land Societies;" at the same time that they tacitly subjoin the more modest appellation of "Benefit Building Societies," and adopt similar rules in their formation, for the purpose of being registered as participators in the privileges of the act of parliament relating to the latter institutions. Their chief object is acknowledged to be the extension of the elective franchise within the present limits of the constitution. The purchase of property, until quite lately, being a merely secondary consideration, or rather a means to the attainment of the political end.

2. "These institutions have, therefore, as might be expected, received the support, and occupied the attention of some of the most active political economists of the present time. In consequence, however, of the difference between their mode of operation, and that of benefit building societies, they can hardly be said to have any right to come within the provisions of the act of parliament by which the above are regulated; and, by several leading authorities, it is held that serious legal difficulties are still likely to arise in the completion of their poli-

* This has been already done by Messrs. Barrett, Exall & Andrewes, in portable engines, *ante* p. 164.

† For an estimate of this loss, and a plate of Mazeline's equilibrium slides, *vide* p. 169, vol. 1849.

* "Industrial Investment and Emigration, being a Treatise on Benefit Building Societies, and on the General Principles of Land Investment exemplified in the cases of Freehold Land Societies, Tontine Principle, in the formation of Benefit Emigration and Colonization Societies." By Arthur Scratchley, M.A., Examiner of the Institute of Actuaries of Great Britain and Ireland. Second Edition. London: John W. Parker and Son, 445, West Strand.

tical purpose. They are, nevertheless, daily becoming more and more important, and increasing in popularity."

3. "Their object," continues Mr. Scratchley, "is simple enough, and easily understood. Proceeding on the principle that land, when sold in the gross, fetches a lower price, per acre, than when sold in small portions, particularly in the vicinity of large towns, these societies purchase, with money obtained from external sources, successively, considerable estates, and divide the same among the members in allotments sufficiently large to constitute 40*s.* freeholds. They undertake in this manner to enable persons with limited incomes to become county voters at a moderate expense. The estimate upon which they proceed is, that 40*s.* freeholds may thus be acquired at a price which any skilled artizan in steady employment may accomplish in the course of five or six years, (the time usually mentioned) by laying aside 1*s.* 6*d.* a week out of his wages for that purpose. It is obvious that, if this assumption be correct (which we will shortly examine), a number of persons contributing to a joint stock fund would speedily raise sums large enough to purchase considerable estates; and the members might, from time to time, be put in possession of freeholds, on paying up the whole price, if they are able to do so, out of their previous savings, or by giving a mortgage on the property, to be paid off by their periodical subscriptions as instalments. The scheme was first tried in Birmingham in a society formed by Mr. J. Taylor of that town. The workmen there had heard of the efforts of the Anti-Corn Law League to carry South Lancashire by registering as many of their members as could be persuaded to purchase 40*s.* freeholds. The average price of such freehold was separately £70; and it occurred to them that, by combining the principles of accumulating a considerable fund through moderate weekly subscriptions, with that of buying land at a wholesale cost, and by dividing it in allotments to subscribers at the same price, 40*s.* freeholds might be brought within the reach of workmen, or at least of the sober and steady members of the skilled artizan class. Persuading others to join them, and securing the countenance and co-operation of several members of parliament, the first freehold land society was founded in the town of Birmingham in 1847."

4. "Its very first purchase of land has been referred to as an instance of the advantage of co-operation. The whole of an estate, for a portion of which, of sufficient size to be suitable for a single house, the owner declined to take less than 3*s.* 4*d.* per yard, was actually bought for a sum which enabled the society to convey it in lots to its members at 1*s.* 1*d.* per yard. These lots are said to have thus cost the new owners about £19 each, and many have erected dwelling houses upon them, while others are stated to have let theirs upon building leases at a rent more than sufficient to give them the franchise.

"The impulse given by this remarkable success was so great, that, ere the termination of the second year, it was found advisable to hold a great conference at Birmingham, in order to organise a plan of general union and co-operation amongst the numerous associations which had sprung up, and which have gone on increasing in numbers to the present day."

5. Mr. Scratchley, whose experience on these subjects entitles his opinion to respect, considers that, apart from other considerations, if the basis of each Society were carefully constructed, the movement might be productive of good; and if extensively taken up by the class of small retail dealers, *employés,* and the superior class of working men, it will not only add to the county constituencies a large number of independent voters, but it will bring within the pale of the constitution, and reconcile to it, an important class of the people. The principle of co-operation adopted, may transfer to the body of members the advantages which single proprietors have hitherto possessed, and may thus enable the many to participate in benefits which have been hitherto enjoyed by the few; it will also occur to every reflecting person that, whatever be the peculiar political tenets of the individuals who thus obtain the right of voting, incalculable advantage cannot fail, by reaction, to accrue to the country at large, from the vast increase which will arise in the number of men who will be personally interested in the preservation of order and tranquillity in the land in which they will have acquired a pecuniary interest. Nor should the moral influence be overlooked which the movement is likely to exert in its tendency to create and foster systematic habits of sobriety and self-denial.

In the words of a distinguished writer, in reference to another class of associations, it may be said that there can be no doubt of the soundness of the policy which would encourage every class to seek to obtain a share in the artificial system of property upon which this country depends. At present the property of the labouring man is all tangible, and immediately at hand. It would not be a great wonder if he were found to have no clear opinion of the rights of a landowner, a fundholder, a mortgagee, or an annuitant; but if he were himself in possession of any of those claims, which, by means of the law can be created, enforced, or transferred, in virtue of the possession of a bit of paper—still more if the comfort of his old age were connected with the legal tenure of his past earnings—he would then be interested in the continuance of that system, by the share of it which belonged to himself.

Other eminent men have remarked to a similar effect, that the object of increasing the number of freeholders at a county election is not an object against law, or sound policy, or morality; on the contrary, that the increasing of the number of persons who enjoy the elective franchise has been held by many to be beneficial to the constitution, and certainly appears to have been the essential object of the legislature in passing the late act for amending the representation of the people.

Also, that a conveyance of land by a vendor to one or more vendees for a *bonâ fide* consideration is valid, although the avowed object of the vendor is to multiply, and that of the vendees to acquire, the right of voting.

Again, "When a working man has saved sufficient to buy a freehold, surely there is no person who will not say that he is glad to see him thus employing the fruits of his industry and frugality?*"

But although the promoters may be sanguine as to the ultimate results of their scheme, on account of the apparently flourishing position of many of the existing freehold land societies, when measured alone by the great number of shares subscribed; yet care does not appear to be exercised to prevent them from falling into the serious errors of reasoning and practice, that have, unfortunately, too often characterised the working of their prototypes, the benefit building societies. The mode of allotting the funds of the association differs but little from that of the latter institutions, while the principle involved is not identical. There is one distinction—the freehold land society is expressly formed to avail itself of wholesale prices in land; and yet, under the Building Societies' Act, it has no authority itself to purchase estates and divide them; and it is powerless, unless a loan can be obtained from some external source in sufficient amount. Hitherto, the movement has been kept up by the liberality of political supporters, who provide the necessary funds in each case; and the rapidity of the extension of these associations proves how little importance is attached to the contingency, that not only will the price of land, in all probability, rise by this increase in the number of purchasers, but in many cases freehold property will not be obtainable at all in such convenient situations, and of such suitable magnitudes, as to meet the object desired.

Mr. Scratchley remarks, that the rules of many of these land societies contain no definite understanding as to the adjustment of the duration of the payments of the members, and no real principle by which, whatever be the time of entry, the profits may be equitably divided

* Speech of Lord John Russell, 5th June, 1849.

among the shareholders, nor any sufficient provision by which a member who may wish to withdraw may be secured from the loss of his right to some benefits from the past success of the association; although in many of the societies, in addition to the weekly contributions of 1*s.* 6*d.*, or thereabouts, by which the positive wholesale cost of the land is to be repaid, an extra payment by way of interest is now being required from the allottees, ranging from 5½ to 6½ per cent. Yet the rules do not seem to guard against an inequality in the advantages that may be obtained by the members, according as they have their land allotted to them at once, or after several years, such as ten or twelve, from the period of commencing their subscriptions; and it is far from improbable, that the ultimate cost to each member of his little property will be widely different. This could only be obviated by the adoption of some more systematic and tabular scale of subscriptions than is at present in use, so as to regulate the duration and amount of the payments by a fixed standard of years and rate of interest, and by paying strict attention to the importance of making the association perfectly mutual, so that the profits on cheap wholesale purchases may go to the general fund, and not to benefit incidental members to the detriment of their successors. The main secret of the prosperity of institutions of this kind consists in the correct adjustment of the relative position of each member, to the exclusion of every attempt at favouritism; and this depends upon a clear understanding existing between the board of directors and the shareholders. We fear that it is too rashly stated, that a freehold qualification for a county can be obtained at the small and definite sum of £20. Such promises should rather be limited to a statement, that while the directors remain responsible managers, all the wholesale property which is bought shall be divided without reservation of profit to those persons who primarily advanced the money, and that the members of the association shall have its refusal at cost price. For whether the cost is to be £20, or to range up to £50, and even £60, it is a matter of vital importance to the success of the principle. It has happened at Birmingham, that several persons obtained sufficient land to give them a qualification for as little as £20; but that arose, in all probability, from accident, and should not be put forward, as it is constantly, as the standard of the price of future purchases.

To the majority of members the pecuniary advantage will rank above the privilege, and to them the most important question will be, what will it practically cost to buy such a quantity of land as will produce, by being leased out or otherwise, an income of £2 a-year, or, what will be the amount of the annual pecuniary profit arising from the purchase? They will calculate that, if even £30 be the average price of such an income, £100 would give £6 13*s.* 8*d.* a year. This alone, over and above the abstract result of a vote, would be so great an attraction, as an advantageous investment, that it would be by far the best the market would afford, more especially with such excellent security as that of land. In the extreme case, where the Birmingham Society bought land wholesale, which only cost £20 for the £2 a year, the rate per cent. of annual profit was a perpetual income of £10 a year. The improbability of such good fortune recurring ought to be sufficient to rouse the industrious classes into making further inquiry into the practicability of these new candidates for popularity; the more so when the member is required to pay for this enormous advantage by such easy instalments as 3*s.* or 4*s.* a-fortnight for five or six years. If the principle be good, when abstractedly considered, it is unnecessary and unwise to expose it to suspicion.

Again, we agree with Mr. Scratchley, that when the land is purchased it will be utterly useless, in a pecuniary sense, to its owner, unless four or five can join together and let their fraction of territory to one tenant, or unless the purchaser contemplates building thereon for his own purposes. A mechanic in a large manufacturing town cannot make any use himself of his land. He is ignorant of its management, and can only make a profit from his purchase by letting it to others; and, even then, the expense of employing an agent, with the uncertainty of collecting the small rent regularly, would diminish the advantage of his purchase. Hence it appears probable, that much discontent will shortly arise among the poorer members of these societies, who have entered under the impression that, in addition to the influence to be acquired by the possession of a county vote, they would be making a highly lucrative investment of their savings. The comparatively rich member, who can take up six or seven shares or more, will reap benefit, not only from the greater certainty of being able to turn his land to account, but also from the increase in the general profits of the institution, which must accrue through the forfeited shares of those members whose means of existence are too precarious to enable them to be regular in their payments.

In the establishment of freehold land societies, their political object has been considered essentially before the question of their capabilities as an advantageous investment for money to the industrious classes. Hence it may be fairly expected that, as soon as the political excitement by which they are now supported has subsided, the directors and others will cease to be so ready to incur the risk of themselves purchasing wholesale tracts of land, for a resale of which, to the members, by the strict letter of the Benefit Building Societies' Act, they can have no security whatever; and any attempt to mix up the pecuniary operations of the society with their own voluntary engagements, will not fail to expose the association to litigation, expense, and loss.

To provide against these difficulties, as far as may be practicable, Mr. Scratchley suggests various improvements, which are deserving of the consideration of those who have connected themselves with these institutions.

These suggestions we will notice in our next number.

NOTES BY A PRACTICAL CHEMIST.

Discovery of a new Metal.—Dr. Owen has discovered a new metal, apparently of the earthy class, holding an intermediate position between magnesia and manganese, for which the name thalium has been proposed. Its oxide, dissolved in hydrochloric acid, is of a beautiful pea-green colour, and gives the following reactions:—Ammonia, a white, bulky precipitate, only sparingly soluble in sal-ammoniac; this is one of the characters which distinguish it from magnesia.—Phosphate of soda and ammonia: the vesicular precipitate caused by this reagent is quite peculiar, and forms one of the marked characteristics of this earth. If the phosphate be added without disturbing the liquid, a number of little vesicles are formed, which remain distinct. The earth, when pure, has the appearance of powdered dried albumen. It has not yet been obtained in the metallic state.

On a brittle form of Silver.—M. Knop has examined some specimens of silver, received from a manufactory of cast-silver articles at Leipzic, very remarkable for their brittleness. This brittle silver was formed in the crucible in which the silver was melted for casting, in form of a scum on the surface, and remained sticking to the crucible when the fluid silver beneath was poured out. The silver had been extracted from the ore by means of muriate of soda. The brittle silver was partly in thin leaves, of the thickness of the back of a knife, with a porous, froth-like surface; partly in thicker masses. The thin pieces had a crystalline, fibrous structure, and the exact appearance of congealed slag, the fibres being perpendicular to the surface of cooling. The specific gravity was 10·25; but the pieces were always inwardly porous. Analysis gave—silver, 97·5; copper, 2·3; silicate of alumina, 0·1. This composition gives no clue to the above-mentioned brittleness. The silver, when re-precipitated as chloride, and reduced by

means of potash and sugar, possessed its usual ductility. Such silver, when changed into chloride, required precisely the quantity of chlorine corresponding to the atomic weight of the silver. The circumstance, therefore, could not arise from some unknown kind of admixture or modification of the silver. That heat causes this phenomenon is not to be supposed; it seems rather to spring from the mixture of small quantities of foreign substances, which change the properties of the metal differently at different degrees of heat. On the solution of silver examined there remained some dense clouds, too little for examination, but evidently containing silver. Is it possible that a small quantity of chloride of silver may remain under certain circumstances in the silver, and cause these phenomena? The supposition may also be ascertained with regard to iodide, bromide, and fluoride of silver.

Reduction of Metals by Phosphorus and Sulphur.—It had been observed by Woehler, that phosphorus in combination with copper excites an electrical current. M. Wicke has made the following original observations:—

1. A stick of phosphorus wound round with a strip of silver was placed in a highly concentrated solution of nitrate of silver. The silver and phosphorus instantly became covered with a blackish film; afterwards silver began to be reduced in a wart-like form upon the strip of silver; and after the lapse of a few weeks, it was covered with an extremely shining coating of crystalline silver, although not in immediate contact with the phosphorus. The whole of the reduced silver could be removed from the strip of silver as a compact coating with a shining inner surface. The phosphorus was only covered superficially with a thin coating of dark phosphuret of silver, and remained unchanged internally. The silver separated so evenly, and with such a shining surface, that this process might perhaps be employed for galvano-plastic purposes.

2. In a similar manner, by a combination of phosphorus and lead in a solution of nitrate of lead, the reduction of crystallised lead took place upon the lead, whilst the phosphorus was covered with a thin black film; the action, however, was weak, and soon stopped altogether.

3. A stick of phosphorus was placed as the axis of a closely-pressed mass of oxide of copper, both covered with water, with which the tube was filled, and then made air-tight; the reduction of the oxide to metallic copper was gradually effected, so that, after several weeks, the stick of phosphorus, which was still remaining, was surrounded by a capsule of crystalline copper.

4. Sulphur, surrounded with a strip of lead and laid in solution of nitrate of lead, effected the reduction of lead upon the lead in form of a loose crystalline coating.

5. When a piece of sulphur, surrounded with a bright copper wire was laid in a saturated solution of sulphate of copper, it became covered, after some time, in the place where the copper touched it, with a loose crystalline coating of indigo-coloured sulphuret of copper, whilst the copper wire was dissolved. A solution of nitrate of copper acted still more rapidly. On the other hand, no action took place on the employment merely of dilute sulphuric acid.

Preparation of Sulphate of Alumina.—Sulphate of alumina and ammonia is placed in shallow earthenware vessels in a drying furnace. When it has lost all its water of crystallisation, it is powdered and placed in a cast-iron cylinder, one end of which is closed with an iron cover, luted air tight. From the other end of the cylinder a bent cast-iron tube issues, connected with leaden tubes perforated with a number of holes, and lying horizontally in a wooden water-cistern lined with lead; the water must absorb the gas evolved. A safety-tube prevents the rising of water into the cylinder. The products of the decomposition of the sulphate of ammonia and alumina are now to be expelled at a cherry red heat; sulphate of alumina remains n the cylinder. The sulphite of ammonia that goes over serves again for the preparation of the alum, after being changed into sulphate by oxidation in the air. The drying furnace lies above the furnace in which the cylinder is heated to redness and is heated by it.

On Cod-liver Oil.—According to some authors, cod-liver oil is a mixture of several proximate organic principles. M. Winckler controverts this opinion. According to him it is an organic whole, containing propyle $C^6 H^7$ instead of glycyle $C^6 H^3$. By the saponification of cod-liver oil with potash he procured oleic and margaric acids. By the distillation of a mixture of 24 parts cod-liver oil, 24 parts water and 6 parts caustic potash, frequently shaken up together during several days, he obtained oxide of propyle. By saponification with oxide of lead he procured no glycerine, but oleic and margaric acids, and a new acid—propylic acid.

ANSWERS TO CORRESPONDENTS.

"Eman, Salop."—We have several reasons for declining to enter upon the "beer controversy."

"Medicus."—Liebig maintains that arsenious acid is capable of forming with albumen a definite and stable compound, but this view is entirely contrary to the results obtained by other chemists.

"Z. A."—To platinise vessels of brass or copper, take 1 part ammonia-chloride of platinum, 8 parts sal-ammoniac, and place them in a flat porcelain dish; add 32 parts of water and let the whole boil. Then dip in the vessels, previously made quite clean and bright. In a few seconds they will be coated with a shining and firmly-adhering surface of platinum.

"Tyro," Durham.—1. Phosphorus must not only be kept under water, but preserved from the action of light. 2. Coal naphtha cannot be used for preserving potassium.

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ON THE CHINA STONE AND CHINA CLAYS OF CORNWALL.

BY MR. H. M. STOCKER, OF ST. AUSTELL.

(Abstract of a paper read before the Royal Cornwall Polytechnic Society.)

The fact that the disintegrated granite and clays of Cornwall and Devon, when fused or burnt, could be rendered available to the potter, was first directed attention to by the late Mr. Cookworthy, of Plymouth, in 1768. That gentleman extensively exported them to the potteries of Staffordshire, from Devon; and subsequently, large beds of a like description of clay were found in the parish of St. Stephens; and a large trade was at once opened, which has continued progressively to increase to the present time. China stone began to be exported at a later period than the China clay, or kaolin; it not having been introduced till the year 1802, when it was first raised from a bed of great purity, containing no iron or manganese, but merely felspar, silica, and mica, in varying proportions; and this is at present the only source from which it can be obtained of a sufficient degree of purity for ordinary purposes. Most of the granites from which the China stone was formed differ from ordinary granite only in the existence in the latter of plates of talc, hornblende, or diallage, which render the China stone in which they are found quite useless, in consequence of the black or brown-coloured slag of silicate of iron or manganese, formed on fusion. The bed from which the article is at present obtained in Cornwall is about three-quarters of a mile in extent, on the contiguous borders of the parishes of St. Dennis and St. Stephens, occupying almost the centre of the central granite district of the county, and is surrounded by other primary rocks of igneous origin, which, as they stretch towards the coast on either side, merge into beds of killas, or clay slate. On the eastern and northern boundaries the granite is more irregular and abrupt in character than on other sides, is more porphyritic, contains a much larger proportion of felspar in large white or red opaque cubic or rhomboidal crystals; while, on the south, it is separated from the neighbouring granite by a large elvan dyke; and it is worthy of notice, that while on one side of this may be found China stone perfectly pure, on the other, only from one to two feet distant, the stone is rendered useless by the presence of small plates of talc imbedded in dense grey granite, which also forms a portion of the eastern boundary. After the expression of some conjectures as to the causes of disintegration of the granite, and the formation of China stone and China clay, Mr. Stocker proceeds:—

At present, while there is a great demand for the article, the spot from whence China stone is procured presents the appearance of a large rabbit-burrow, as there are no less than nine setts for the district, the proprietor of each of which has his portion of the hill covered with the mouths of pits, around which are stationed a number of men with their waggons, who, after

the China stone has been raised by quarrymen and the employment of powder, carry it to one of the nearest ports to be shipped for the potteries of Staffordshire and Worcestershire. These ports of shipment are distant from seven to nine miles from the quarries; the distance necessitating a considerable amount of land carriage and a consequent increase in the price of the article, which of late years has been raised from 12*s.* to 20*s.* per ton free on board, at Par, Pentewan, or Charlestown. Still, the demand has by no means diminished, and the proprietors of these setts have been obliged to fix a certain limit to their annual supply, of 18,000 tons, at which rate of consumption all the China stone in these beds will have been removed in rather less than fifty years.

The number of people employed in its preparation is comparatively small, as the operation of blasting requires but two or three persons in each pit; and in loading the waggons, the parties employed as carriers are but too eager to fill, in order to get a load.

Mr. Stocker goes on to state the constituents of China stone, which, in its purest state, consists of a mixture of quartz, felspar, and mica, blended so as to form a homogeneous mass, which very much resembles granite, though its texture is not so compact; and he gives his opinion that until some cheap mode be discovered of separating deteriorating ingredients—hornblende, diallage, talc and iron—the China stone at present in use must retain its pre-eminence, consisting, as it does, of a pure double silicate of potass and alumina, which, when fused, forms a pearl-white translucent mass, firm and resonant, consisting of an opaque body, of nearly perfectly-formed kaolin, surrounded by and diffused through the glaze of silicic acid, to which its transparency is due. Not only does the presence of the before-mentioned deteriorating substances render the article useless, but should there be a very great excess of quartz crystals or silica, the article will not be capable of fusion at any temperature; though this fault may be remedied by the addition of either potass or soda.

The mode in which the China stone or clay is prepared, for the purposes of pottery, is thus described:—The China stone is ground to a fine powder, by means of a number of stones which are kept rotating on the bottom of a vat, when it, as well as the clay and ground flint, is mixed with a certain quantity of water, till it becomes of the consistence of cream. It is then passed through a series of cambric or lawn sieves, kept rapidly revolving by a water-wheel: each pint of the clay slop weighing twenty-four ounces, while that of the flint or China stone weighs thirty-two ounces. It is then passed through a very fine silk sieve, after which these ingredients are mixed together in various proportions in a large vat or tub; and as soon as the mixture has attained its requisite consistence, the water is driven off by evaporation, and, as this process causes the slop to contain numerous air globules, it is submitted to a process of kneading or beating; after which it is considered to be fit for the lathe. Formerly, it was thought necessary that the mass, after kneading or beating, should lie fallow for three or four months; but this plan has been abandoned.

Of the extent of the trade in China clay, Mr. Stocker writes, that when obtained by Mr. Cookworthy in 1768, from the Lescrouse and Trethose clay works, in the parish of St. Stephens, a large supply was at once demanded for the Staffordshire potteries, which has gradually increased till the present time. The average annual export of past years, which he has been enabled to supply through the kindness of the most influential shipping agents in the neighbourhood, is as follows:—

At Charlestown	40,000 tons	of China clay.
At Par	10,000	ditto.
At Pentewan	18,000	ditto.
At other harbours	12,000	ditto.
Total	80,000 tons.	

From the little attention paid to former exports of this article, he has been unable to form an accurate estimate of them; but some idea of the increase may be gleaned from the following estimates of the value of the exports of the manufactured article to the various countries with which England has any commercial relations:—

In 1835	£280,000	shipped from Staffordshire.
1837	560,000	ditto.
1841	600,759	ditto.
1851	1,210,000	ditto.

Adding to this the exports from the Derby, Worcester, and other potteries, we gain a total of £2,150,000 shipped during the past year; in addition to which, of late years, a considerable amount of crude kaolin has been exported to many potteries on the continent and in America, while a small portion has also been used for bleaching.

"Kaolin (Mr. Stocker proceeds) is found intermixed with quartz, and scales of mica, in most valleys contiguous to the decomposing hills of the primary strata of our county, and is not, as is the case, as far as is at present known, with regard to China stone, confined to any particular district, being now obtained or obtainable, though of different qualities, on the south-western sides of any of the granite districts; yet, of course, purest near those beds of China stone which are free from most deteriorating substances, as in the parish of St. Stephens.

"It exists in these beds, or stopes as they are designated, as an amorphous whitish blue opaque powder, and, from the softening influence and rainy character of the south-westerly winds, these beds are most frequent in valleys situated on the same aspect; often lying on the contiguous borders of the granite and killas, clay slate, grauwacke, or transition strata, by which this is surrounded; where, being exposed to the action of lodes and co-existing springs, on the occurrence of the slightest convulsion, it has slid to the adjacent valleys, where its presence is indicated by the generally smooth and flattened appearance of the surface, by the vegetation in it, which is often luxuriant, especially if the clay contains an excess of potass, and by the number of springs to which it gives rise in the immediate vicinity; their height being above the level of the sea is necessarily limited by that of the valleys in which it is deposited.

"The character of the clay very much assimilates to that of the granites, from which it has been formed by disintegration, not only as to the quantity obtainable from a given amount of clay stope, but also as to the purity of the article, and its whiteness; the whitest clay being formed from that granite which has the whitest felspar, and is most free from iron, the presence of this giving the manufactured wares an appearance termed 'foxy;' while, lastly, the amount of mica scales, which give to them their tenacity or strength of body, considerably influences the character and value of the clay, so that, as a general rule, we can form a very good diagnosis of the character of the clay, by an examination of the granite from which it has been formed; and, in doing this, I would advise the use of a good microscope, by which the clay-producer can only hope to obtain an accurate knowledge of the value and purity of our clays.

"The kaolin of both Devon and Derbyshire is of good working quality, but can by no means compare with that of our county, either for whiteness or strength. It contains sixty of alumina, twenty of silica, and twenty of potash (Wedgwood), and to this peculiarity of constitution (excess of silica) is due the property of being infusible and unchanged at the highest temperature; it is extremely tenacious of moisture, and hence one great difficulty in its preparation, to be hereafter discussed.

"The clay beds or stopes are formed by small irregular crystals of quartz, the edges of which are by no means so well marked as in the granite, nor is their opacity so great; the mica is apparently unchanged, consisting of silicic acid, potash, and alumina in the form of double silicate, while the felspar of the granite or China stone by the loss of its potash has become converted into the amorphous powder I have just described; a single instance of the effect of slight natural chemical changes, giving rise to the formation of two such dissimilar bodies, when fused, as biscuit china, white, glassy, sonorous, and translucent; when, if the disintegrating process have but just overstepped this limit, we find, on fusion, a brick-like mass, white, opaque, adherent to the tongue, tenacious of moisture, and earthy on fractures. There are, however, many and varied intermediate productions, from the pasty pipe-clay, or tile, to porcelain or glass, which is but another form of a fusible silicate.

"The clay stopes are oftentimes rendered useless by the presence of some iron lode, which causes them to become loosened in texture and reddened. The stope is then termed "branny," and this has to be thrown aside as useless.

"Having thus briefly given a general outline of the nature, composition, and history of these clays, I shall proceed to the notice of the mode of preparation of them in this county, which, though simple in theory, requires much care and attention in its execution, and consists essentially in the separation of the quartz from the mica and kaolin, and the subsequent collection of the latter.

"The execution of this process in any of the extensive works in St. Stephens' parish, one of which would cover from ten to thirteen acres of ground, and from which 2,000 to 3,000 tons are annually raised and fitted for the market, forms a curious and interesting spectacle of white-washed, happy industry, for the contemplation of the traveller, during the months of summer.

"Distant about from five to eight miles from St. Austell; situated in the centre of barren, rugged, heathery wilds, enclosed by stone walls, and bordered on every side by cold, bleak, rugged hills, these works have a very picturesque appearance. In one part of them may be seen from thirty to forty men, boys, and women, who, with their white bonnets, white aprons, and sleeves, carry the still whiter clay in large junks to the surrounding hills or drying grounds, to be exposed to the warm rays of the sun, the dry winds, and the bleaching power of the air; in another may be seen other parties scraping the clay, prior to its being packed in casks, to be sent to various parts of the old and new world. Circular or oval pits and square pans are lying in all directions, their continuity here and there disturbed by one or two water-wheels in incessant motion, or piles of dried clay, covered with reeds, or lying in sheds; while at one extremity of the works may be seen a number of men and boys employed in excavating the clay stope, removing the overburden, or streaming the stope to wash away its clay, the sand at the same time being removed to the drying-ground by means of a tramroad, the waggons passing along which are worked by the aid of water power; while overhead, launders (gutters), attached to pumps for various purposes, seem to perform a skeleton roof to the whole.

"The beds of clay stope are exposed by the removal of the overburden, which varies in thickness; in some places lying but a few feet from the surface, while in others the only bed fit to be washed is placed at a depth of from ten to twenty fathoms from the surface. The removal of the superimposed earth is effected by a number of men, with their pickaxes and shovels; they then

transport the earth to the adjacent rugged country, so as to render it smooth and level, in order to form drying fields for the summer. Whilst this is in progress, the clay stope, over the top of which flows a small stream of water, is being excavated by another set of men, which, as the water passes through, has the clay suspended in it, by the kneading action to which the stope is subjected by means of the large boots, often seven pounds weight, with which the 'clay streamers' are supplied. The sand is thus separated from the clay and mica, which are carried on by the water, and the sand is then carried by rail or carted to the top of the work, whence it is taken to be spread over the drying grounds, or it is thrown into the pits and pans.

"The water to be supplied to the clay stope should consist of two-thirds of spring to one-third of rain-water, this mixture causing a deposit of the suspended clay much more readily than any other. Great attention is often necessary in this part of the process; from an excess of rain-water it is often requisite that it should be saturated with some earthy base; common alum is at present used for this purpose, though any other cheap salt would answer the purpose, as it is only necessary to saturate the water fully with earthy bases, when the clay speedily becomes thrown down—a law not generally known.

"As a substitute for this, I have, at times had recourse to finely-ground peat, or wood charcoal, which, thrown over the surface of a pit on which it floats, by a process of angular attraction or repulsion, causes the clay to be deposited even from distilled water far more readily than by the addition of any soluble earths, as may be demonstrated with ease by experiments in two or three tumblers; but, as I am rather in advance of the water in which I left the clay and mica suspended at the bottom level of the clay work, I must return thither, till, by the aid of wooden or iron pumps from forty to eighty feet deep, worked by a powerful water-wheel, this milky-looking fluid is elevated to the level of the large mica launders, where the clay, being lighter than it, leaves it deposited in these inclined pits, which are generally three or four in number, placed in tiers, with a slight elevation at the upper end of each. They vary in length from ten to twenty feet, are generally three feet in breadth, and six or nine inches deep, though both the number, size, and degree of inclination vary with the size and rapidity of flow of the stream of water, no less than with the amount of mica contained in the stope. In some clay works the stream is so large, that most of the mica is carried on with the clay, so that it possesses, when fused, a greater degree of tenacity, though of an inferior quality as to whiteness, plasticity, &c. In the separation of the best clays, these pits require that the motion of the stream through them should be slow and equable, the stream of small size, and the launders should be trapped or cleaned out once every six or seven hours; a careful attention to which will repay any amount of labour in the production of a good article. That portion of the mica collected in the first of these launders, often having mixed with it scales and crystals of hornblende or diallage, is thrown aside as useless, while that collected in the others is generally sold as a second quality clay.

"The clay water having left the micas, now flows on to a large circular or oval collecting pit, thirty or forty feet in circumference, and from six to ten feet deep, where the clay subsides, forming an under strata of the consistence of cream, the supernatant water flowing off from the top of the pit, until it is filled. As soon as this happens, the clay is allowed to pass out by a trap-hatch, to the pans below it; or should there be none at this level, recourse is had to the pumps, by means of which and attached launders, the clay is passed to the drying pans in any portion of the works. Of these, there should be from ten to twelve capable of holding from forty to fifty tons to each large collecting pit. They have been made, till lately, on any part of the adjacent ground, frequently on that covering the clay bed, where the surface, after being levelled and covered with fine loose gravel, is edged in by walls of granite, the joints of which, as well as those of the pits, are rendered impervious by interposed moss; they are generally from twenty to forty feet square and two feet deep; the pans when two-thirds filled with the clay are thus exposed to the heat of the sun or the dry winds of March, to the aid of which alone the proprietors of the majority of these works have hitherto had recourse.

"In the model which I have sent for the inspection of the committee of the Royal Cornwall Polytechnic Society, I have employed drainage as an additional means of aiding the drying of clay, by forming a kind of filter of the clay pan. A substratum of large pebbles, increasing in depth from behind forwards, but with the surface level, is first laid down above this coarse gravel, between which and the clay to be dried is a thin layer of fine sand; through this the water quickly runs to the corner towards which the inclined bottom is made to flect, which communicates with the country by means of a launder, over the inner end of which is placed a wire-gauze grating; by the employment of these, from experiments I have made, I have ascertained that the clay can be dried thrice as rapidly as by the ordinary methods; in addition to the introduction of which, I should recommend to the notice of parties employed in these operations, the propriety of placing their pans as closely together as possible, so that, on the occurrence of heavy showers of long duration, or in the heavy dews of the nights of summer, the clay may be kept from this accession of moisture by some cheap covering, as these obstacles very much increase the difficulty of drying clay in any given period.

"The kaolin is by this means only partially deprived of moisture. In order to effect its complete removal, it is taken from the pans, where it has been allowed to remain from three to four months, to the drying grounds on the hills, in summer, in cubic blocks about one foot square. In order to effect its removal from the pans, a number of parallel incisions are made the whole length of the pan in one direction by means of a perpendicular knife attached at right angles to a long handle; these long blocks are then divided transversely by men, who with spades throw them on a board, on which they are carried by women and boys to a sandy drying-yard, where they soon become perfectly dry and white; but as this can only be done in summer, and not even then if a wet season, it has become necessary that recourse should be had to other means. Those hitherto employed have all required the use of a fuel obtainable only from Newport or some distant coal district, and hence requiring considerable outlay, so much, in fact, that but few persons are able or willing to make use it. The heat, in these cases, is applied by means of a large kiln, or by passing the clay over a heated drum, neither of which could be made available in the return of several thousand tons of clay annually.

"But it appeared to me that the deleterious floods of the winter, or the wind on the adjoining hill, might be rendered available as a motor power, provided it could be employed in the construction of a kaolin drying machine. The success of my attempts will be best learned by a few turns of the handle of the accompanying model, made and invented by the author, by one of which, twelve times the size of the model, two tons of clay can be dried completely every five minutes. It consists of a number of perforated fans, having on them shelves similarly perforated, or made of wire-gauze, which are kept rotating 200 times per minute, or faster, if necessary, by the four attached multiplying wheels. These wheel-fans have six perpendicular screen-like arms, on each of which are a number of transverse shelves for the carriage of the clay, where, from the rapid motion of the wheel, and the opposed currents of air it causes to be thrown against the clay, it rapidly becomes dry.

"The fact of doing away altogether with fuel, and the substitution of a power which can be obtained with the greatest ease, on the occurrence of a very rainy season, render it at once a cheap and advantageous substitute, either for the labour at present employed, or for the still more expensive fuel.

"The junks of clay, after being again collected, are now piled away in sheds, under a number of thatched gates or reeders, or are placed in some sheltered spot, so that they may nevertheless have a constant current of cold dry air surrounding them, and be at the same time kept from rain. When required for exportation, these square blocks are scraped by a number of the clay women, who, armed with their 'Dutch-hoe'-like instruments, as they surround the scraping tables, present a rather formidable appearance; after this it is piled in waggons, to be sent from one of the nearest ports, or is packed in a number of small casks, each capable of holding about half a ton, in which it is sent off.

"The prices of these clays vary much with the quality of the article, although they seldom alter as far as those of a superior stamp are concerned, which have held their price for the last ten or fifteen years, and always command an excellent sale in the market at from 36*s.* to 46*s.* per ton; while those of an inferior quality may be procured at any price below this, down to 17*s.* per ton, varying with their purity, hardness after calcination, degree of whiteness, both in and out of water, and, lastly, the degree of shrinking they undergo on calcination or fusion.

"Having already entered as fully as the limits of the present essay will permit me on the subject of the uses of kaolin, further information on that head must be dispensed with; but, before concluding, I must introduce to your notice a few facts, bearing directly on the influence the preparation and production of this article exercises on this, the central portion of the county. The first and most important of which is, the number of people employed in its preparation, and the amount of capital expended annually in labour; next, I shall show the amount of the cost of land dues; thirdly, that of land carriage, which will necessarily afford additional aid to the labourers in the vicinity, as the whole of this work is executed by a number of small farmers, each of whom is generally provided with his waggon and team of from three to four horses; the cost of cooperage and quay dues is next on the list; forming a total of £240,500 spent in the preparation and production of this article in this country alone; but it should also be recollected that no less than 80,000 labourers are employed in the neighbourhood of the Staffordshire potteries, and 20,000 more in those of Derby, Worcester, Wales, and Bristol, in its subsequent manufacture, while, prior to its arrival in or at either of those districts, a sum of 12*s.* per ton for carriage by sea and canal is entailed, forming a total of about £300,000 spent in China clay and stone, before it arrives in the potteries, where an immense amount of capital is again spent in its manufacture.

"Labour, 7,200 men, women, and children, 1*s.* 6*d.* per diem	£197,100
Carriage of clay and stone to one of the nearest ports at average price	22,000
Dues to landowner	14,000
Dues to proprietors of harbours	2,500
Cooperage on best clays	5,000
	£240,500
Load and canal carriage at 12*s.* per ton	58,800
	£299,300

"Having thus as briefly as possible stated the chief facts with which I am

33

acquainted, relative to the history, preparation, and commercial importance of these articles; after reiterating the advantages derivable, and the field of improvement offered for contemplation and study, to the enterprise of the Englishman, in the substitution of machinery for the great amount of manual labour and cost, at present necessarily entailed by the previously existing want of information on this subject, I must conclude by again calling attention to the distance of these beds from the potteries, and their surrounding beds of fuel, which by substitution at a subsequent period may considerably alter the present state of the central portion of the county, and with it the price of the various articles of pottery so necessary to our comfort and convenience."

August 27th, 1852.

MANUFACTURING PROGRESS IN ENGLAND.

(Illustrated by Plate 20.)

A MOST interesting history might be written of the rise, progress, and decline of the various branches of art for which certain manufacturing towns in this country are, or have been, celebrated. Time was, when the West of England "broad cloth" had no competitor, when Bristol was *the* great port of the kingdom, and when the western district, extending from Gloucester to Exeter, filled a more important position than it is likely ever again to occupy. On the east, again, Norwich has lost what Bradford has gained, and it is not long since Staffordshire was threatened with a dangerous opposition in the shape of Northampton iron ore. Amongst the various towns which have "held their own," Birmingham stands pre-eminent. Here manufacturers have never been content to follow a declining trade; and no sooner does one branch of business show symptoms of being exhausted, than another vein is hit upon, with a judgment which is rarely at fault.

We look upon the gain to the capitalist as only one of the advantages to be derived from this system of universal adaptation to the wants of the day. The artizan class, instead of dragging on a miserable existence like the hand-loom weavers of Spitalfields, or some of the mechanical trades at Sheffield, reap as much, if not more, advantage, for they naturally possess, in a less degree than their employers, the power of taking up a new branch of trade.

The spread of information, however, is doing wonders, and we learn from an article in the *Sheffield Times*, which has suggested the present train of ideas, that a successful effort has been made in that town to introduce a new manufacture, the brass trade, a branch which has been, hitherto, almost monopolised by Birmingham.

It is obvious that an establishment starting unencumbered in the race of competition has a better chance of success than an older rival, just as our new railways have the advantage of obtaining gratuitously the advantage of experience already gained in construction and working. Accordingly, in the case before us, the Atlas works have been established on the largest scale; and as it is not often that we have the advantage of obtaining such a graphic description as in the present instance, we shall avail ourselves of the opportunity of giving an abstract of the article in our contemporary.

"The Atlas works have been founded by Messrs. William W. Cutts and Co., for the prosecution of a manifold business—the manufacture of gas-fittings, chandeliers, oil lamps, candle lamps, plumbers' brass foundry, and railway lamps and signals. Within a very recent period the site which these stupendous buildings now occupy was a piece of unappropriated ground, large enough to afford pasturage for one or two cows. It is now the theatre of a system of mechanical operations, which give regular and well-paid employment to hundreds of artizans. That small area of suburban pasturage is destined to occupy the largest entire building for manufacturing pursuits ever erected within the precincts of old Hallamshire, and which at this early day has become the seat of a vast thriving trade. The situation of the new works is near the Sheffield terminus of the Midland Railway, on the east side of New Saville-street, and exactly opposite to the Cyclops works. The general aspect of the building, as the engraving shows, is in Sheffield by no means common; it has more the appearance of those lofty, extensive, regularly-built structures observable in Manchester and the clothing district. Messrs. Weightman, Hadfield, and Goldie are the architects; and they have, by this example, proved themselves as capable of providing a building perfectly adapted to manufacturing pursuits as an edifice of higher architectural pretensions. The building is of brick, with stone facings; and while it makes no great pretensions to ornamentation, it presents that pleasing appearance which is always associated with appropriateness. One of its chief characteristics is perfection of arrangement—a quality which, in many of our local manufactories, is remarkably wanting, in consequence of their having undergone a series of enlargements and alterations necessitated by increased business, but neither provided for nor contemplated in the original structure. In this respect the Atlas works possesses a great advantage. Some idea of the vastness of the concern is afforded by the fact that the site is upwards of two acres in extent, and the principal front of the building about 500 yards long.

"The principal building is arranged in three storeys, each of which is an unbroken level, and consists chiefly of ranges of very long and lofty rooms, the apartment on the several floors varying in height from 10 to about 13 feet. Each room is lighted by a row of circular-topped windows on both sides, set in iron frames. In the entire suite of buildings there are more windows than days in a year.

"It is impossible to observe the hundreds of industrious hands in active operation at this vast hive of industry without thinking of the immense benefit which its establishment must have conferred upon the working classes directly, and upon every other class consequentially; including an inconsiderable portion of outworkers, the proprietors of the Atlas works give employment to some four hundred individuals. The industrial population of Sheffield is benefited in a peculiar manner, inasmuch as, while most of the skilled trades are effectually hemmed in by stringent trade-union regulations, this new branch of business acts to a great extent as a safety-valve, by absorbing a large amount of labour. Every worker is paid on a liberal scale, in proportion to his or her individual worth, altogether independent of any factitions operations contrived to create an artificial scarcity of labour. Another interesting fact is the great diversity of persons employed. While many of the operations are such as require the highly-educated hand and eye, there is a large amonnt of work so simple as to admit of being done by boys and adults of both sexes who have not had the advantage of a specific mechanical training. None of the work involves great expenditure of muscular strength; and much of it, being closely associated with the beautiful in art, must be of a very pleasant nature. A more commodious set of workshops, or better constructed with respect to the laws of health, we have never had the satisfaction of inspecting. Everything is kept in a state of admirable order and cleanliness. The contrast presented to some of the Sheffield manufacturing establishments, as well in internal circumstances as in external appearance, is very broad indeed. Everything is reduced to a harmonious system. Discipline is a principle that prevails amongst the artisans of Sheffield less perhaps than in any other part of the country; whereas, in this individual establishment we observe the manufacturing system at work with a smoothness and precision very remarkable for a concern of such recent origin. The order and regularity that prevail are producing a marked effect upon the workpeople, in their habits as well as appearance. The juveniles must of necessity turn out a more sober and industrious class, in consequence of the training which they here undergo. A code of rules have been introduced, and are observed with great cheerfulness, the intelligence of the workpeople convincing them that any little sacrifice of personal freedom is not only justified by the circumstances of the case, but amply compensated by the manifold attentions paid to their comfort and convenience by the proprietors. The reasonableness of the rules and their necessity are evinced by the perfect facility with which they were introduced and their successful working.

"To give a detailed description of the various and complicated *modus operandi* involved in the productions of this manufactory is beyond onr present purpose. The following brief sketch of the successive processes may not, however, be uninteresting to the uninitiated. Every new design is in the first instance modelled in wax, after the same manner as in the silver trade. The design is then transferred to lead, as a material easily worked. From the lead a brass casting is taken, which is highly chased by skilled

hands, and becomes a permanent pattern, from whieh any number of duplicates may be cast. The casting is carried on as a totally distinct department from the rest of the works, in a range of roomy, well-adapted buildings at tbe rear of the structure shown in the drawing. The art of casting in brass has of late years arrived at a high degree of perfection. At the Atlas works all the ornamental castings have a fine, sharp, crisp outline, which gives to tbem the spirit of the original design, and leaves very little to be accomplished by subsequent processes. Some asperities necessarily remain, however, to be dressed off; but the operation is a very simple one, and it gives employment to a great number of boys, who may be seen in the fitting-rooms standing in long rows, filing away with amusing briskness. The castings, having now undergone the process of dressing, are given to skilled workmen to be made up into an infinite variety of beautiful ornamental objects. In this department a very large proportion of tbe hands in the entire establisbment are employed. This department having been completed, the articles, now complete in respect of form, are dipped in acids, in order to approximate them to that deeper rich colour which finally they assume. The burnishing process follows, imparting a new and beautiful effect. After that the operation of lacquering is performed, which gives completeness to the colour: in other words, an artiele of brass so treated assumes the glowing richness of Australia's choicest auriferous treasures. This last process is carried on exclusively by women, in separate apartments. The chandeliers, lamps, &c., that have to be bronzed are of course treated in a very different manner, the higher departments of bronzing being a close secret, preserved with scrupulous care from the uninitiated. The bronzer works alone in a remote room like an old alchymist, with all the solemnity and reserve of a civilised "mystery man." This arcanum being so closely guarded, the etiquette of the establishment forbids a closer ken. We therefore quit the scene, and join company with a more ordinary class of mortals, namely, the men who apply the touchstone, as it were, to the various articles of manufacture, in order to make sure that everything is sound and tigbt, for "Sheffield wasters" are strictly tabooed at the Atlas works.

"The department most attractive to tbe ordinary visitor to tbe Atlas works is the sbow-room, an exceedingly bandsome and spacious apartment at the north-western extremity of the building, very tastefully fitted up and decorated, stored with a great variety of rich elegant chandeliers and lamps, costly and otberwise, fabricated at tbe establishment. One sees here a variety of novel styles, designed in accordance with the purest taste, and adorned with oriental splendour, before which a Chinese 'feast of lanterns' would pale its fires. Not only do we find tbe highest beauty of form, but the most charming combinations of colour—an intermingling of burnished and dead gold, electro-silver, ormolu, elegant porcelain and Bohemian glass, finely modelled Parian marble figures, rich bronze, sparkling crystal-like glass, &c. Tbe best specimens of bronze work are in nowise surpassed by those charming products, in respect of which, at the Great Exhibition of 1851, the French bronzers ranked pre-eminent. But, amidst a profusion of costly splendour, the cheap and useful class is by no means unrepresented; there are several new specimens which command notice, from the fact of tbeir possessing in a very striking degree the qualities of great and general utility, beauty, and extreme cbeapness. Tbe 'patent Atlas nigbt-lamp,' for instance, is a perfectly unique contrivance, and being sold for a trifling sum at the retail shops, is likely to become very popular. Tbese lamps are produced in bronze and also witb opal glass pillars. At an infinitesimal cost tbey burn without occasioning any trouble, and in perfect safety, for seven or eight consecutive hours, and they may be carried about witb the greatest facility, the glass being so secured, that it cannot fall off, and of sucb a form, tbat the light cannot be extinguished by a current of air. Amongst tbe other novelties which arrested our attention as we inspected the sbow-room, was the Atlas oil-lamp, for the sole manufacture of whicb Messrs. William W. Cutts and Co. have recently obtained Her Majesty's royal letters patent. The simplicity of its mechanical arrangement, the ease witb wbich it is trimmed and replenished, and the beautiful, brilliant, steady, gas-like light wbich it emits, must cause an increase of the present great demand for the article, and extend Messrs. Cutts' reputation to every part of tbe world where a good artificial light, unattended by trouble, is appreciated.

"Another new design, a cbandelier for a drawing-room, we observed, which struck us as a remarkable combination of beauty with perfect novelty. The design is modelled from a bough of crisp, sparkling holly, the stems, green leaves, and bright red berries represented in their proper colours, a perfect counterpart of nature. Beautifully-modelled birds in Parian marble are seen perching upon the twigs, and coloured glass shades of harmonious design are placed in the interstices between the boughs. A more cheerful ornament of tbe drawing-room on a winter night could scarcely be imagined. The picturesque foliage of the oak, rich in acorns, the graceful lily, the vine, the hop, and numerous otber of nature's choicest products, are wrought up in like manner, and made to produce the most delightful effects. The mind cannot dwell upon tbese creations of the artist's fancy without a gratifying consciousness that tbe relation between our local manufactures and ornamental art bas been largely extended, and one is led insensibly to reflect upon the consequently rising value and importance of that seminary of artistic merit the Sheffield school of design, the policy of fostering which with a liberal hand is daily becoming more apparent.

"A pleasing and not unimportant manifestation of taste and spirit associated with the Atlas works is displayed by the style of the pattern books. The pattern books sent out by other houses in the trado are even at tbe present day of the old stereotyped order—plain coarse black and white engravings or litbographs, sbadowing forth very imperfectly the articles they are intended to represent. A pattern book of the Atlas works is a very different and vastly superior affair. Not only are the pages very large, but the specimens are executed after the manner of Digby Wyatt's finely-illustrated new work, 'Tbe Industrial Arts of the Nineteenth Century:' in fact, they are got up in a style tbat renders them a becoming ornament for the drawing-room table. In a purely mercantile point of view, however, we are disposed to regard tbis new style of pattern book as vastly more important than it may at first sight appear."

The advantage of this to purchasers at a distance can hardly be overestimated, as they are enabled to judge accurately of the style which they must adopt, in order that no want of harmony may be felt between the various fittings and furniture of the rooms to be lighted—a most important point, and one often entirely overlooked.

DIMENSIONS OF NEW STEAMERS.

THE "PRINCESSE MATHILDE," "CHAMOIS," AND "CASTOR."

Built by M. Nillus, of Havre (France). Engines by the same, of 70, 50, and 25 (nominal) horse-power

"PRINCESSE MATHILDE."

Dimensions.	ft.	tenths.
Length on deck	145	2
Breadth of beam	16	8
Depth of hold do.	8	5
Length of engine-space	26	0
Tonnage.	**Tons.**	
Hull, displacement load	145	

Oscillating engines, with tubular boilers.

		ft.	ins.
Diameter of cylinders		2	9
Length of stroke		2	10
Diameter of paddle-wheel over boards		14	6
Length of boards		5	5
Length of do.		2	3
Number of do.	10		
No. of boilers	1		
Length of do. at bottom		7	0
Breadth of do.		9	10
Height of do., in all		8	6
No. of furnaces	3		
Breadth of do.		2	8
Length of fire-bars		6	2
Number of tubes	243		
Internal diameter of do.		0	$2\frac{1}{2}$
Length of do.		6	0
Diameter of chimney		3	4
Height of chimney		21	0
Load on safety valve, in pounds, per square inch		$22\frac{1}{2}$ lbs.	
Area of immersed section		50 sq. ft.	
Contents of bunkers, in tons		6 tons.	
		ft.	ins.
Draft forward		3	6
Do. aft		4	0
Average revolutions		46 to 50	
Weight of engines and boilers with water		42 tons.	

DESCRIPTION.

Frames, 3 inches × $2\frac{1}{2}$ inches × $\frac{3}{16}$ inch, and 1 foot 8 inches apart; number of strakes of plates from keel to gunwale, 5; thickness of plates, $\frac{3}{16}$ and $\frac{3}{16}$; number of bulkheads, 5; masts, 2; no bowsprit; round stern; schooner-rigged. The bow

falls perpendicularly in the water. She is intended to run from Havre to Rouen, in four hours and a half, including stoppages; the distance is 36 leagues.

This steamer is on the stocks, and will be ready next month of April, to begin her service by summer time. This steamer is very sharp at the bow, and the engines are very near the stern; boiler is after the engines, nearer the stern.

"CHAMOIS."

Dimensions.	ft.	tenths.
Length on deck..	118	2
Breadth of beam	14	6
Depth of hold do.	8	1
Length of engine-space	22	0
Tonnage.	Tons.	
Hull, displacement load	80	
Oscillating engines, with tubular boilers.		
	ft.	ins.
Diameter of cylinders	2	5
Length of stroke..	2	6
Diameter of paddle-wheel over boards..	14	0
Length of boards	4	5
Depth of do.	1	9
Number of do. ..	11	
Number of boilers	1	
Length of do. at bottom	6	5
Breadth of do. ..	7	11
Height of do., in all	8	0
Number of furnaces	3	
	ft.	ins.
Breadth of furnaces	2	1
Length of fire-bars	6	0
Number of tubes..	196	
Internal diameter of do.	0	$2\frac{3}{4}$
Length of do. ..	5	4
Diameter of chimney	2	8
Height of do.	21	0
Load on safety-valve in pounds per square inch	$22\frac{1}{2}$ lbs.	
Area of immersed section	48 sq. ft.	
Contents of bunkers, in tons	5 tons.	
Consumption of coals per hour	7 cwt.	
Date of trial	July, 1850.	
	ft.	ins.
Draft forward ..	3	6
Do. aft ..	4	0
Average revolutions	42	
Speed in knots with tide	14 knots.	
Do. against tide ..	11 „	
Weight of engines and boilers with water	34 tons.	

"CASTOR."

Dimensions.	ft.	tenths.
Length on deck	85	0
Breadth of beam	13	10
Depth of hold do.	7	10
Length of engine-space	18	0
Tonnage.	Tons.	
Hull, displacement load	60	
Oscillating engines, with tubular boilers.		
	ft.	ins.
Diameter of cylinders ..	1	10
Length of stroke..	1	$10\frac{1}{2}$
Diameter of paddle-wheel over boards..	11	6
Length of boards	4	0
Depth of do. ..	1	3
Number of do. ..	12	
Number of boilers	1	
Length of do. at bottom	5	8
Breadth of do. ..	5	6
Height of do., in all	7	0
Number of furnaces	2	
Breadth of do. ..	1	10
Length of fire-bars	5	4
Number of tubes	130	
Internal diameter of do...	0	$2\frac{3}{4}$
Length of do. ..	5	0
Diameter of chimney	2	2
Height of do.	20	0
Load on safety-valve in pounds per square inch	15 lbs.	
Area of immersed section	30 sq. ft.	
Contents of bunkers, in tons	3 tons.	
Consumption of coals per hour..	$3\frac{1}{2}$ cwt.	
Date of trial	July, 1849.	
	ft.	ins.
Draft forward ..	3	0
Do. aft	3	4
Average revolutions	38	
Speed in knots with tide	13 knots.	
Do. against tide	9 „	
Weight of engines and boilers with water	15 tons.	

REVIEWS.

The Assayer's Guide. By Oscar M. Lieber, late Geologist to the State of Mississippi. Philadelphia: H. C. Baird. London: Trubner and Co.

THE appearance of the present volume is well-timed; and when so much attention is directed to the mineral wealth of our colonies, it cannot fail to be acceptable to a large circle of readers. It is eminently practical in its tone, and, without being diffuse, gives sufficient detail of the apparatus employed, as to enable the student to manufacture for himself wherever the raw material is available. We believe the author is correct in saying that his work will fill the void between the too scientific and the too popular divisions of chemical literature; and we are also glad to repeat his commendations of two other treatises, which the student may consult with advantage, if he have mastered the languages in which they are written. The one is the *Traité des Essais par la Voie Sèche*, by Berthier; Paris, 1834: the other, in German, "Instructions on Assaying, for Miners and Smelters," by Bodeman; Clausthal, 1845.

The Encyclopædia of Chemistry. By James C. Booth, A.M., M.A.P.S., Melter and Refiner in the U. S. Mint, Professor of Applied Chemistry in the Franklin Institute. Assisted by Campbell Morfitt. Second edition. Philadelphia: H. C. Baird. London: Trubner and Co. 8vo., pp. 974.

To review an encyclopædia such as this would require at least a whole number of the *Artizan.* We may give our readers an idea of its contents by comparing it with Dr. Ure's *Dictionary,* which it resembles in its chemical character, whilst it is superior to that work, inasmuch as the history of the science is brought down to a later date. An admirable feature in it is, the constant reference to the authorities of which the editor has availed himself—a system which enables the student to refer, without trouble, to the best sources of information on any special branch of the subject to which he wishes to apply himself.

We hope to avail ourselves, as occasion may offer, of the immense mass of information contained in its pages. The price at which it is published is very moderate; but any of our readers who might wish to examine a copy before ordering it, are at liberty to do so, on presenting their cards at our office.

A new general Theory of the Teeth of Wheels. By Edward Sang, Professor of Mechanical Philosophy in the Imperial School, Muhendis, Hana Berrii, at Constantinople. Edinburgh: A. and C. Black.

THE author of this work appears to have endured a most enormous amount of labour in producing a monument of mathematical research. He confesses in the introduction, that it is impossible to render all his investigations intelligible to those unacquainted with the integral and differential calculus, but we find no attempt to smooth the path to the great body of practical men, who, we imagine, will still prefer the simple formulæ of Professors Willis and Cowper. If a mechanic, anxious to make his stock of wheels of the most approved form, were to purchase this book only, he would throw it down in despair, and go on in his old rule-of-thumb style for the rest of his life. Mr. Sang reminds us of those stars which shine very brilliantly in their own spheres, but are so immeasurably elevated above this common-place world, that their usefulness is very materially diminished.

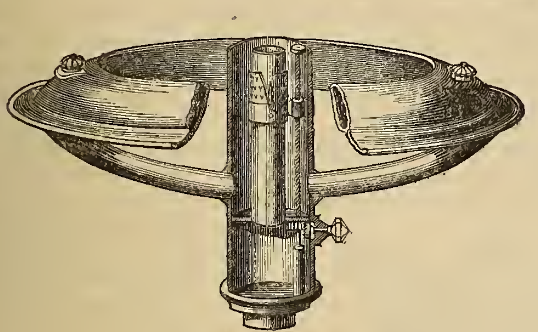
The Practical Lithographer. By Cyrus Mason. London: published by the Author.

THIS little treatise contains some practical hints on the manipulations of lithography, which will, we doubt not, be found valuable in removing the difficulties in the path of the student, whilst those unacquainted with the art may be tempted to learn it, when they find there is not so much mystery about the matter as might be imagined.

THE ATLAS LAMP.

ON a recent visit to the show-rooms of Messrs. Cutts and Co., in Hatton-garden, we were shown a new and ingenious lamp just patented, and not yet, we believe, issued to the public. We have tried a great many lamps, and never found one yet which was not attended with some disadvantage. The one before us appears to be less open to ob-

jection than any other we have seen; the accompanying engraving will explain its peculiarities. The lamp is of that form in which the reservoir of oil is placed level with the wick, and forms the support for the glass shade; part of it is supposed to be removed, to show the interior. There are two novelties—one, the way in which motion is given to the wickholder, and the other the method of attaching the wick, without using the ordinary cotton-stick. The wickholder slides on the outside of the air-tube, in the centre of the lamp, and is commanded by a vertical screw, to which motion is given by a pair of small bevel wheels,



the driving one being turned at pleasure by means of a small button on the outside of the lamp. This arrangement very much simplifies the mechanism of the lamp, and renders it less liable to get out of order.

The method by which the wick is fixed is equally simple and ingenious. The wickholder is made in two parts, which hinge upon one another in such a way that, when fully raised, it can collapse from the cylindrical form shown in the sketch, into the conical form, and the wick can thus be readily slipped on the reduced diameter. But when the wickholder is screwed down, the centre tube, over which it passes, compels it to open, and hold the wick securely.

Messrs. Cutts and Co. have a profusion of elegant chandeliers, and other apparatus for lighting, from the most economical to the most expensive, some of which we may take occasion to notice. In the meantime, any of our readers will find their time well bestowed in paying them a visit.

MILLER'S PATENT SLIP.

At p. 45 of the present volume, we have given an engraving of the patent hydraulic purchase machinery, patented by Mr. Miller, C.E., for raising vessels on slip docks, and as we have had some inquiries from persons not intimately acquainted with the details of slip docks, we have thought it worth while to give a general engraving of the whole machinery, which will be more readily understood by the uninitiated.

Fig. 1 is a side elevation of the vessel on the slip, the weight of the hull being taken by a series of trucks connected together, the wheels of which run on a railway of three rails on the slip. Figs. 2 and 3 are transverse sections of the slip, looking from the stern and the stem respectively.

Fig. 3 is a view of one arrangement of the hydraulic purchase machinery. A is the cylinder of the hydraulic press; B the ram, the motion of which is communicated to the truck by the links *d*, *d*. F is the cylinder of the steam-engine which gives motion to the pumps H, the supply from which is regulated by the cock *k*.

As we have already explained, the immense power obtained by the hydraulic ram draws up the ship; and when the ram has made one stroke, it is disengaged from the links, and, one link being taken out, the ram is allowed to descend, and a fresh hold taken; and so on, until the vessel is raised the desired height.

Fig. 1. Fig. 2. Fig. 3.

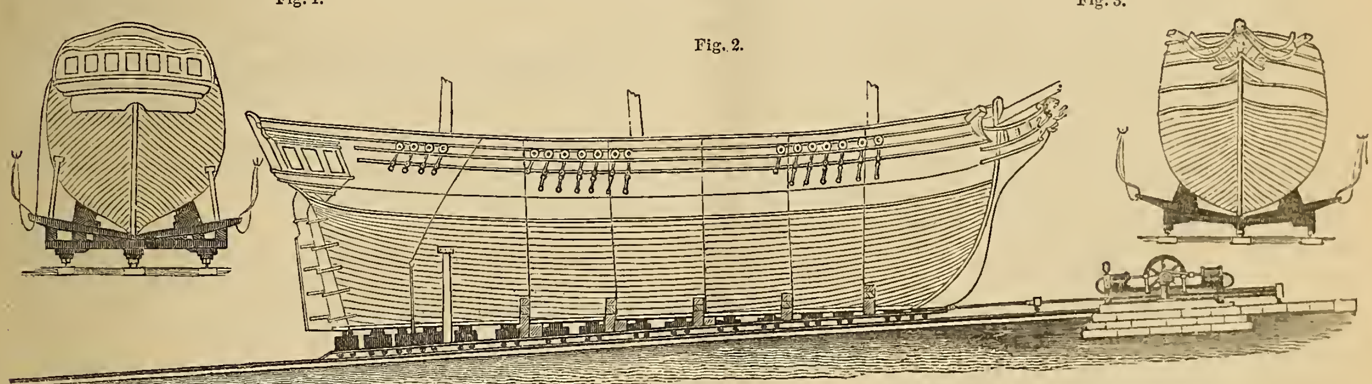
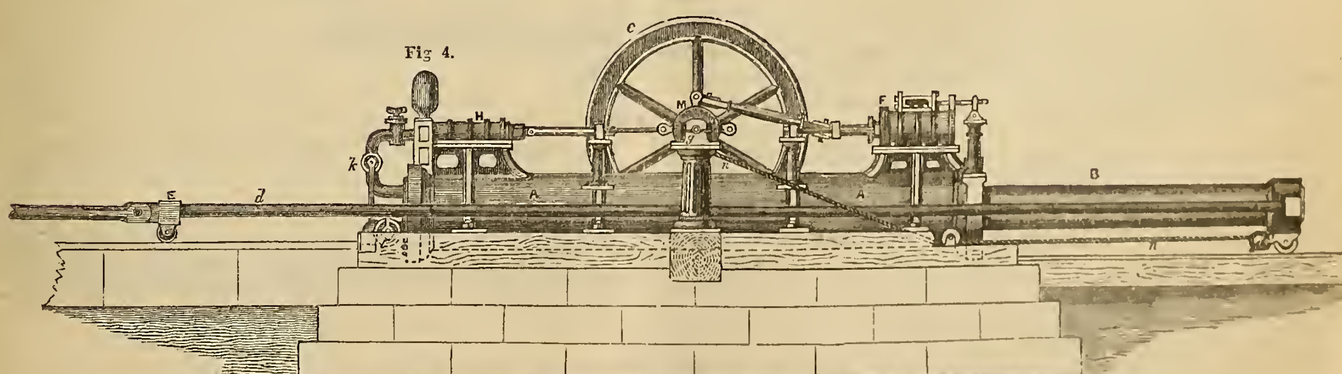


Fig. 4.



BRIÈT'S PATENT GAZOGENE APPARATUS.

One of the most useful inventions which we have seen for some time, is the above apparatus, which has been submitted to us by M. Mathieu, the representative in England of the manufacturer, and which we have engraved. By its use, any liquid can be impregnated with any of the gases formed by the mutual decomposition of bodies in the presence of the fluid, and with this advantage, that the materials employed do not come in contact with the body of the liquid. The apparatus is more especially applicable to making soda water, ginger beer, lemonade, &c., which can be made at convenience, and kept for any length of time without deteriorating in quality.

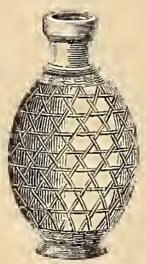


Fig. 4.

Fig. 5.

Fig. 1. Fig. 2. Fig. 3.

Fig. 1 is a side elevation of the apparatus complete, drawn to a scale of $1\frac{1}{2}$ inch to a foot. When it is to be charged, the top receiver is screwed off, and being inverted, as in fig. 2, is filled with water or any desired liquor. The powders to form the gases are then poured into the lower receiver, fig. 3, by means of the funnel, fig. 4. In the inside of the apparatus, fig. 1, will be seen a tube, shown separate at fig. 5. This tube is inserted into fig. 3, and the receiver, together with the pipe, inverted, and screwed into receiver fig. 2. By re-inverting the whole apparatus, as in fig. 1, the operation is completed. A small quantity of the water in the upper receiver flows down the pipe, and mixing with the powders in the lower receiver, causes the disengagement of the gas, which bubbles up into the upper receiver, and not being able to escape, is subjected to considerable pressure, which assists its absorption by the water. By opening the cock shown in the side, the aërated water is drawn off at pleasure. An apparatus of this description may be seen in operation at our office.

NOVELTIES.

New Water Gauge.—The annoyance and expense caused by the breakage of gauge glasses often causes their disuse, although there can be no doubt of their great value, seeing how large a proportion of boiler explosions occur from shortness of water. We notice in the American *Mechanic* a description of an invention designed to remedy this objection, invented by a Mr. Echol. A correct idea of it may be formed by supposing the glass to be taken out of an ordinary gauge, and a metal tube substituted, having in the centre two bosses, one back and one front. Into each of these bosses is screwed a brass plug, containing a glass lens, which will obviously show daylight through the centre of the tube. If now, a strip of glass, or other suitable material, be marked with a series of numerals, a float be fixed at the upper end of it, and the whole be placed in the tube, it is obvious that, as the level of the water varies, the float will rise, and the various figures be visible through the lens, and the level of the water thus observed.

The advantages claimed by the inventor are, that, owing to the strong form of the glass, and its being constantly immersed in the water, it will be much less likely to be broken, whilst, at the same time, by shutting the cocks, if that accident should occur, the broken lens can be taken out, and a spare one screwed in in a few minutes. Another advantage, perhaps, would be, that the light of a small lamp placed behind the back lens would be magnified, and the figure accurately noticed.

Culverwell's Registered Portable Vapour-Bath.—It must be confessed that in this country we have very little notion of the sanitary uses of the bath. With the million, it is only regarded as a means of cleanliness, to be used occasionally in hot weather, although its beneficial effect in such a variable climate as this ought to make it an appendage to every house. The vapour-bath, from the small space which it occupies, and the ease and rapidity with which it can be prepared, deserves to be more generally adopted. A neat and economical form of it has been submitted to us by Mr. W. Culverwell, a gentleman of the medical profession. The annexed sketch shows the apparatus for supplying the vapour. It consists of a boiler, *b*, which is filled

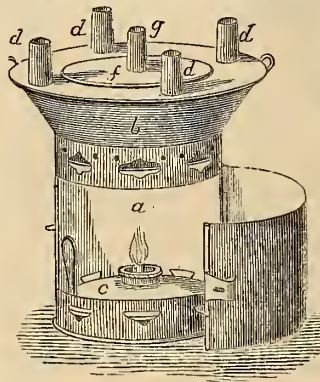


Fig 1.

Fig. 2.

with water (either pure, or medicated, as may be required), and is heated by the spirit-lamp, *c*. As soon as the water boils, dispersers, fig. 2, are placed over the steam jets *d, d, d, d*, fig. 1, and the apparatus is placed under a cane-bottomed chair, upon which the patient sits, enveloped in a blanket or other suitable covering. The temperature of the bath may be varied by adjusting the wick of the spirit-lamp to give more or less heat. By adapting a flexible tube, fig. 3, to one of the steam jets, stopping the rest, the vapour can be conveyed to any part of the body

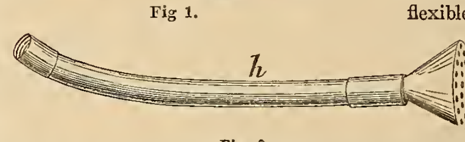


Fig. 3.

From personal experience we can speak of the beneficial effects of the vapour-bath in preventing the progress of that very disagreeable malady, popularly understood as "taking cold," if it be only applied in time.

Clayton's Patent Pipe-joint.—Some difficulty has been experienced in making the joints of the earthenware pipes now so commonly adopted for drainage purposes. Mr. Clayton has patented a very convenient method of doing it, which renders the pipes perfectly smooth, inside and and out. Fig. 1 is a single pipe, prepared for jointing in this way, by which it will be seen that one end of the pipe is cored ont, whilst the other end is turned down, to suit. The pipes, when laid together, as in fig. 2, form a perfectly flush joint, which possesses many advantages. Mr. Clayton has a very

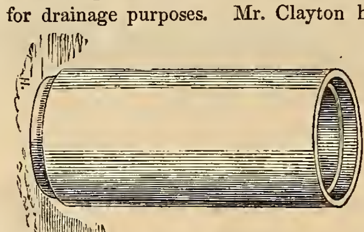


Fig. 1.

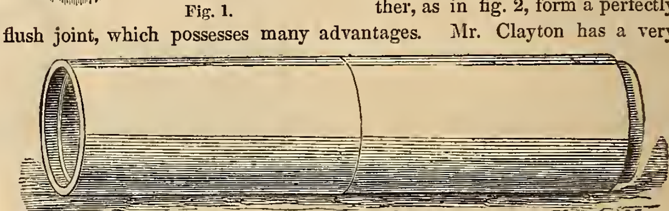


Fig. 2.

pretty machine for making the pipes to this form, which we will describe on some future occasion.

CHANNELS FOR INVESTMENT.
LIST OF NEW COMPANIES RECENTLY ESTABLISHED OR PROPOSED.

	Amount of Share.	No. of Shares.	Capital.
Strood, Canterbury, and Dover Railway	£25	60,000	£1,500,000
Great Western and City Junction	20	15,000	300,000
Severn Valley Railway	20	30,000	600,000
Isle of Wight Railway	10	24,000	240,000
Hull and Holderness Railway	20	6,000	120,000
Dartmouth, Brixham, Torbay, and South Devon Railway	10	12,000	120,000
Boston and Midland Company's Railway and Dock	10	30,000	300,000
South Midlands Union Railway	20	45,000	900,000
Mid-Kent and London Railway	20	50,000	1,000,000
Cheltenham and Oxford Railway	20	30,000	600,000
London and Mid-Western Railway	20	50,000	1,000,000
Staines, Wokingham, and Woking Railway	20	15,000	300,000
Montgomeryshire Railway	10	25,000	250,000
West-End and Crystal Palace Railway	10	38,600	386,000
Belgian Eastern Junction Railway	£5 sh. 40 deb.	42,500 4,500	392,500

NOTES FROM CORRESPONDENCE.

*** We cannot insert communications from anonymous correspondents.

"Ericsson's Caloric Engine."—"An incredulous one," wishes to know whether it has been ascertained that the air will pass through the regenerators at the requisite speed, without occasioning a large amount of back-pressure. We presume that that has been taken into account; but we must confess that the information accorded to the public by Captain Ericsson is so meagre, that no proper grounds exist for forming an opinion upon. We do not think the public have a right to complain, but it justifies them in suspending their judgment. With reference to the regenerators acting with sufficient rapidity—a point on which we expressed a doubt (p. 177, vol. 1851)—it has been suggested, that small drills are cooled almost instantaneously by merely passing them through the air.

"P. H."—A very neat planing machine can be made by working the table to and fro by means of a double-threaded screw, the length of the machine, the motion and speed of which can be changed by crossed straps, as usual, without any bevel-gear or toothed wheels at all. We have seen such a one at Messrs. Summers & Co.'s, Southampton, of their own make, which gives great satisfaction.

"C. F. H."—A rope, made of twisted cow-hide (untanned) is used in rope-grounds, to convey power a long distance, and would probably answer his purpose. It is much superior, in durability, to the best hemp rope for that purpose.

"Lucifer."—We have a sketch of a match-machine in hand for him.

Patent-Office Regulations.—Strangers who write to us for information on the Patent-Office regulations must enclose twelve postage stamps, for a reply, as we are overwhelmed with letters on the subject, which it would take the whole time of a clerk to answer.

Books received.—"The Canadian Journal;" "The American Mechanic;" (both new periodicals); Fincham's "Outlines of Ship-building;" Bell's "Outline from Outline;" "The Farmer's Magazine."

A bottle of "Harding's Cherokee Zest, or Royal Household Sauce."

LIST OF ENGLISH PATENTS,
From 27th of September to 21st October, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Henry Medhurst, of Clerkenwell, Middlesex, engineer, for improvements in water-meters, and in regulating, indicating, and ascertaining the supply of water and liquids. September 27.

Auguste Edouard Loradoux Bellford, of Castle-street, Holborn, for improvements in the manufacture of boots and shoes, part of which said improvements are also applicable to the manufacture of various other articles of dress. (Being a communication.) September 30.

Moses Poole, of London, gentleman, for improvements in the manufacture of combs. (Being a communication.) September 30.

Sarah Lester, of St. Peter's-square, Hammersmith, Middlesex, executrix of the late Michael Joseph John Donlan, of Rugeley, Staffordshire, gentleman, for improvements in treating the seeds of flax and hemp, and also in the treatment of flax and hemp for dressing. (Being a communication from the said M. J. J. Donlan.) September 30.

Christopher Nickels, of York-road, Lambeth, manufacturer, and Benjamin Burrows, of Leicester, for improvements in weaving. September 30.

Henry Gardener Guion Jude, of Lower Copenhagen-street, Barnsbury-road, Islington, for improvements in the manufacture of type. (Being a communication.)

Charles Billson, of Leicester, manufacturer, and Caleb Bedells, of Leicester aforesaid, manufacturer, for improvements in the manufacture of articles of dress where looped fabrics are used, and in preparing looped fabrics for making articles of dress and parts of garments. September 30.

Edouard Moride, of Nantes, France, for certain improvements in tanning. September 30.

William Hunt, of Stoke Prior, Worcester, manufacturing chemist, for certain improved modes or means of producing or obtaining ammoniacal salts. September 30.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 166, Fleet-street, London, patent agents, for improvements in knitting machinery. (Being a communication.) October 7.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of 166, Fleet-street, London, patent agents, for improvements in the manufacture of sugar, and in the machinery and apparatus employed therein. (Being a communication.) October 7.

Alexander Sbairp, of the Patent Office, 166, Fleet-street, London, for an improved cutting and slicing machine. (Being a communication.) October 7.

John Reed Randell, of Newlyn East, Cornwall, farmer, for improvements in cutting and reaping machines. October 7.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in washing, bleaching, and dyeing flax and hemp, and in mixing them with other textile substances. (Being a communication.) October 7.

Solomon Andrews, of Perth Amboy, in the United States of America, engineer, for improvements in machinery for cutting, punching, stamping, forging, and bending metals and other substances, which are also applicable to the driving of piles and other similar purposes, and to crushing and pulverising ores, and other hard substances. October 7.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in steam and other gauges. (Being a communication.) October 11.

Richard Archibald Brooman, of Fleet-street, London, patent agent, for improvements in mowing, cutting, and reaping-machines. (Being a communication.) October 14.

Walter Ricardo, of the firm of A. and W. Ricardo, of London, share-broker, for improvements in gas-burners. (Being a communication.) October 14.

Thomas Carter, of Padstow, Cornwall, ship-builder, for improvements in propelling. October 14.

John Field, of Warnford-court, Throgmorton-street, for improvements in transferring and printing. October 14.

William Brown, of Heaton, near Bradford, York, mechanist, for certain improvements in machinery and apparatus for preparing and spinning wool, hair, flax, silk, and all other fibrous materials. October 18.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for an improved mode of manufacturing railway chairs. (Being a communication.) October 19.

Joseph Palin, of Liverpool, Lancaster, wholesale druggist, and Robert William Sievier, of Upper Holloway, Middlesex, for improvements in brewing; and also in the production of extracts or infusions for other purposes. October 19.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for sewing. (Being a communication.) October 19.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus applicable to public carriages for ascertaining and registering the number of passengers who have travelled therein during a given period, and the distance each passenger has travelled. (Being a communication.) October 19.

Edward Henry Jackson, of Titchfield-street, Soho, Middlesex, machinist, for certain improvements in producing artificial light, and also in producing motive power. October 21.

Edward Brailsford Bright, of Liverpool, Secretary to the English and Irish Magnetic Telegraph Company, and Charles Tilston Bright, of Manchester, telegraphic engineer, for improvements in making telegraphic communications, and in instruments and apparatus employed therein and connected therewith. October 21.

William Reid, of University-street, electric-telegraph engineer, for improvements in electric telegraphs. October 21.

William Boggett, of St. Martin's-lane, Westminster, gentleman, and George Brooks Pettit of Lisle-street, Westminster, gas-engineers, for improvements in obtaining and applying heat and light. October 21.

John Charles Wilson, of the Redford Flax Factory, Thornton, near Kirkcaldy, of Fife North Britain, civil engineer, for improvements in the machinery and processes employed in and for the manufacture of flax and other fibrous vegetable substances. October 21.

LIST OF IRISH PATENTS,
From the 7th of September to the 11th of September, 1852.

Joshua Crockford, of Southampton-place, Middlesex, gentleman, for improvements in brewing and in brewing apparatus. September 7.

Henry Bessemer, of Baxter House, Old Saint Pancras-road, Middlesex, for improvements in expressing saccharine fluids, and in the manufacture of refining and treating sugar. September 11.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS DEPOSITED.

Edwin Bates, an invention for retarding and effectually stopping at discretion railway carriages, and also for carriages of all descriptions, for the more safely descending inclined planes, either in the streets, or on turnpike roads, to be called "Bates's Break." Oct. 1.

Henry Mortlock Ommanney, an improvement in the manufacture of guns, cannon, and other ordnance. October 1.

Henry Mortlock Ommanney, an improvement in the manufacture of cylinders for hydraulic presses and other engines. October 1.

Henry Mortlock Ommanney, an improvement in the manufacture of wheels for railway carriages. October 1.

Henry Mortlock Ommanney, an improvement in the manufacture of stamp-heads for crushing ores. October 1.

Professor Andrew Crestadoro. Certain improvements in Impulsoria, or machinery for applying animal power to railways, waterways, and common roads, and to other mechanical purposes, part of which improvements relate to railway and other carriages, to buffers, springs, breaks, and chains, and in the propelling vessels across liquid elements. Oct. 8.

PROVISIONAL PROTECTION UNDER THE NEW LAW.
Dated October 1, 1852.

1. Robert Adams. Improvements in ball cartridges.
2. George Henry Brockbank. Improvements in upright pianofortes.
3. Peter Spence. Improvements in obtaining power by steam.
4. James Hodgson. Improvements in constructing iron ships and vessels.
5. Joshua Smith. Improvements in table knives.
6. Moses Poole. Improvements in the manufacture of guns and pistols.
7. John Henry Gardner. Improvements in toilet tables.
9. George Green. Improvements in the manufacture of casks.
10. Freeman Roe. Improvements in valves and cocks.
11. Thomas Wood Gray. Improvements in cocks and valves.
12. Thomas Wood Gray. Improvements in steam engines.
13. Edward Lambert Hayward. Improvements in lock spindles.
14. Thomas Christy. Improvements in weaving hat plush, and other piled fabrics.
15. Joseph Barker. Improvements in fastenings.
16. Moses Poole. Improvements in the manufacture of telescope and other tubes.
17. Charles Henry Newton. Improvements in protecting electric telegraph wires.
18. Thomas Dickason Rotch. Improvements in treating peat, and in manufacturing fuel and other products therefrom.

19. Moses Poole. Improvements in moulding articles, when India-rubber combined witb other materials are employed.
20. Charles Frederick Bielefeld. Improvements in constructing portable houses and buildings.
21. George Duncan and Arthur Hutton. Improvements in the manufacture of casks.
22. Henry Walker Wood. Improvements in tbc constrnction of sbips and other vessels.
23. Jean Baptiste Lavanchy. Improvements in wind musical instruments wbere metal tongues are employed.
24. Moses Poole. Improvements in making covers for, and in binding, books and portfolios, and in making frames for pictures and glasses.
25. John Mackintosh. Improvements in regulating and governing the flow of fluids.
26. John Macintosh. Improvements in evaporation.
27. John Macintosh. Improvements in packing for steam engines and otber macbinery.
28. Moses Poole. Improvements in coating metal and other substances with a material not bitherto used for sucb purposes.
29. Jobn Daniel Ebingre. Improvements in the manufacture of animal charcoal.
30. Moses Poole. Improvements in the manufacture of trunks, cartouche and other boxes, in knapsacks, pistol-holsters, dressing, writing, and other cases, and sword and other sheaths.
31. John Dunkin Lee. Improvements in covering railway trucks and other vebicles.
32. William Pym Flynn. Improvements in paddle-wheels.
33. Moses Poole. Improvements in the manufactnre of pails, tubs, baths, buckets, measures, drinking and other vessels, basins, pitcbers, and jugs, by the application of a material not hitherto used in such manufactures.
34. Robert Beart. Improvements in the manufacture of bricks and other articles tbrough moulding orifices.
35. Tbomas Huckvale. Improvements in instruments for administering medicine to horses and other animals.
36. James Hare. Improvements in expanding tables and in music stools.
37. Moses Poole. Improvements in covering and sheathing snrfaces with a material not bitberto used for such purposes.
38. Tbe Honourable William Erskine Cochrane. Improvements in unloading coals from ships or vessels.
39. Felix Abate, and John Julius Cléro de Clerville. Improvements in preparing, ornamenting, and printing on snrfaces of metal and other substances.
40. Frederick Richard Holl. Improvements in watches and chronometers.
41. Joseph Barrans. Improvements in steam-engine boilers.
42. Oswald Dodd Hedley. Improvements in getting coal and other minerals.
43. Moses Poole. Improvements in harness, and in horse and carriage furniture.
44. James Hodgson. Improvements in machinery for draining land.
45. Charles William Rowley Rickards. Improvements in tongs for screwing pipes and tubes.
46. James Stewart. Improvemcnts in the action of pianofortes.
47. Stephen Perry. Improvements in inkstands or inkbolders.
48. Edmund Morewood and George Rogers. Improvements in rolling metals.
49. Edmund Morewood and George Rogers. Improvements in coating metals.
50. Walter Henry Tucker. Certain improvements in locks (applicable to locks for all purposes), by which they can be made so as to combine increased and perfect security with simplicity and cheapness of construction.
51. Thomas Craddock. Certain improvements in the steam engine and the steam boiler.
52. Walter McLellan. Improvemcnts in tbe manufacture of rivets and in working in metals.
53. Thomas Browne Dalziel. Improvcments in thc treatment or manufacture of textile fabrics or materials.
54. George Pearson Renshaw. Improvements in turn-tables and traverse-tables, and in apparatus connected therewith.
55. George Mumby. Improvements in the manufacture of envelopes, and the machinery, apparatus, or means to be employed therein.
56. John Finlay. Improvements in grates and fire-places, or apparatus for the generation of heat.
57. John Joseph Macdonnell. Certain improvements in the construction of railways.
59. Marcus Davis. Certain improvements in the manufacture of carriages, carts, military and other wagons, and wheels for locomotive and other purposes.
60. William Wolfe Bonney and Robert Archbutt. Improvements in machinery for raising a pile on linen, cotton, silk, or other fabrics.
61. John Baylis. Improvements in hatbands and armlets.
62. John Sayers. Improved arrangements for maintaining a level surface or level surfaces upon or in connection with bodies subject to a rocking motion.
63. John Fordham Stanford. Improved machinery and apparatus for manufacturing bricks, tiles, and similar building materials, which is hereby denominated "The Complete Brickmaker."
64. Henry Richardson Fanshawe. Certain improvements in shawls, scarfs, neckerchiefs, handkerchiefs, mantles, sails or sail-cloth, table-cloths and table-covers, napkins, and umbrella and parasol tops and covers, and in an improved loom for weaving, applicable especially to the said improvements, in respect to some of the said articles.
65. James Stocken. An improved plaster spatula.
66. George Holmes. Certain improvements in the manufacture or construction of coats, capes, and other upper garments of personal attire.
67. James Brown. An improved method of making ships' or other vessels' anchors.
69. William Moore, and William Harris. An improvement in repeating pistols and rifles.
70. Robert Lakin, and William Henry Rhodes. Improvements in machines for spinning and doubling cotton and other fibrous substances.
71. John Ambrose Coffey. Improvements in apparatus for performing various chemical and pharmaceutical operations, hereby denominated "Coffey's Improved Patent Esculapian Apparatus," parts whereof are applicable to steam boilers, steam and liquid gauges, stills, and syphons.
72. Edward Wilkins. Improvements in the distribution and application of water or other liquid manure to promote vegetation.
73. Edward Wilkins. Improvements in ruling and folding the leaves of account-books or other books used for mercantile purposes, and in making entries therein, and delivering vouchers therefrom, with accuracy and dispatch.
74. Christopher Kingsford. Machinery for solidifying peat, coal, and other substances of a like nature.
75. Laurentius Mathias Eiler. An apparatus to release or separate carriages on railroads in case of accident, giving at the same time a signal of distress.
76. Christopher James Schofield. Improvements in machinery or apparatus for cutting the pile of fustians and other fabrics.
77. Stephen Soulby. Improvements in machinery for letter-press printing.
78. William Smith. Improvements in machinery or apparatus for cleaning currants, raisins, and other fruits or vegetable substances.
79. Henry Smith. Improvements in reaping machines.
80. Matthias Walker. An improved asb-pan or apparatus for taking up ashes and cinders, and separating or sifting them.
81. Frederick Osbourn. A machine or apparatus for facilitating the mauufacture of various kinds of garments or wearing apparel.
82. Henry Mortlock Ommanney. Improvements in certain parts of machinery for spinning cotton and other fibrous substances.
83. Henry Mortlock Ommanney. An improved furnace for melting of metals in crucibles.
84. Edwin Pettitt. Improvements in the manufacture of ammoniacal salts and manures.
85. Joseph Brandeis. Improvements in the manufacture of sugar and saccbarine solutions.
86. David Dunne Kyle. An improved method of excavating and removing earth.
87. Robert Robertson Menzies. Improvements in tbe manufacture of carpets, and other fabrics.
88. George Holcroft. Certain improvements in steam engines.
89. James Nichols Marshall. An improved wheel for carriages and other vehicles.
90. John Aspinall. Improvements in evaporating cane juice and otber liquids, and in apparatus for that purpose.
91. William Walker. Improvements in wheels for railway carriages, and in tbe mode or modes of manufacturing the same.
92. Thomas Lawes. Improvements in the manufacture of agricultural implements, or an improved agricultural implement.
93. Thomas Lawes. An improved quilt or coverlet.
94. Thomas Lawes. Improvements in generating steam.
95. William Oxley. Improvements in apparatus for heating and drying.
96. Henry Bridson. Improvements in machinery to facilitate the rinsing, wasbing, and cleansing of fabrics, which macbinery is also applicable to certain operations in bleaching and dyeing.
97. John Macmillan Dunlop. Improvements in the manufacture of wheels for carriages.
98. Thomas Firth. Improvements in macbinery for preparing to be spun, wool, mohair, flax, cotton, and other fibrous materials.
99. Robert Anderson Rust. Improvements in pianofortes.
100. William Potts. Improvements in sepulchral monuments.
101. Thomas Allen. Improvements in the application of carbonic acid gas to motive purposes.
102. George Rennie. An improved chain cable.
103. Charles Lungley. Improvements in ship-building.
104. Martyn John Roberts. Improvements in tbe manufacture of oxides of zinc and tin.
105. Richard Arcbibald Brooman. Improvements in macbines for cleaning knives.
106. Thomas Allen. Improvements in propelling.
107. Henry Columbus Hurry. An improved construction of fouutain pen, or reservoir penholder.
108. Thomas Fearn. Certain improvements in ornamenting metallic snrfaces, and in machinery and apparatus to be employed therein.
109. William Austin and William Sutherland. Improvements in ornamenting glass.
110. John Wright and Edwin Sturge. Improved machinery for tbe manufacture of envelopes.
111. John Remington and Zephaniah Deacon Berry. Improvements in gas meters or apparatus for measuring gas or other elastic fluids.
112. Hermann Turck. Improvements in packing goods.
113. Richard Harczyk. An improved preparation or composition of colouring matter to be used in washing or bleaching linen and other wasbable fabrics, and in the mannfacture of paper and otber substances.
114. George Jenkins. Improved means of obtaining motive power throngh an atmospberic engine, by facilitating the attainment of exhaustion by currents of caloric, the engine being worked by tbe pressure of tbe atmosphere.
115. Charles John Carr. Improvements in machinery for making bricks, and other similar articles.
116. William Bolivar Davis. Improvements in ships' buoys, life bnoys, ships' tenders, aud other similar articles.
117. John Wilson Fell. Improvements in preparing and spinning hemp and otber fibrous materials, for the purpose of making ropes, twines, and other similar articles.
118. Alexander Stewart. Improvements in the manufacture or production of ornamental fabrics.
119. George Ennis. Improvements in gaffs and booms.
120. George Collier. Improvements in the manufacture of carpets and other fabrics.
121. John Lee Stevens. Improvements in furnaces.
122. Duncan Bruce. Improvements in rotary steam engines.
123. Richard Wbytock. Improvements in the manufacture of fringes, and of plait for these and otber ornamental work.
124. Ricbard Husband Heighway. Improvements in paving roads and other snrfaces.
125. Thomas Hunt, Improvements in fire-arms.
126. George Bell. Improvements in saturating canvas and other fabrics in order to render them buoyant and waterproof.
127. Robert W. Parker. A new or improved mode of giving rotary motion to a shaft of a circular saw, or other mechanical contrivance.
128. William Rogers. Improvements in studs, buttons, and other fasteners.
129. Joseph Cox. Improvements in the mannfacture of gates and hurdles.
130. Isaac Westborp. Improvements in grinding wheat and other grain.
135. Robert Griffitbs. Improvements in apparatus for indicating the number of persons entering and the distance travelled in public or other conveyances and places, and for the prevention of frand upon proprietors of public conveyances.
136. William George Nixey. Improvements in tills and other receptacles for money.
137. Arthur Jackson. Improvements in gas burners.
138. Ricbard Atkinson Peacock. An improved construction of culverts for sewers, for the purposes of drainage.
139. William Lewis. Improvements in compounding medicines in the form of pills.
140. Thomas Robson. Improvements in apparatus for igniting signal and other lights.
141. Astley Paston Price. Improvements in the manufacture of citric and tartaric acids, and of certain salts of potash, soda, ammonia, lime, and baryta.
142. Henry Bernoulli Barlow. Improvements in the manufacture of cylinders for carding cotton and other fibrous substances.
143. John Lawreuce Gardner. Improvements in bottles and other vessels for holding liquids.
144. William Seaton. Improvements in the construction of iron vessels, and in sheathing or covering the same.
145. Donald Nicoll. Improvements in mourning bands for the arm or hat.
146. Edwin Lewis Brundage. Improved machinery for forging nails, brads, and screw brads.

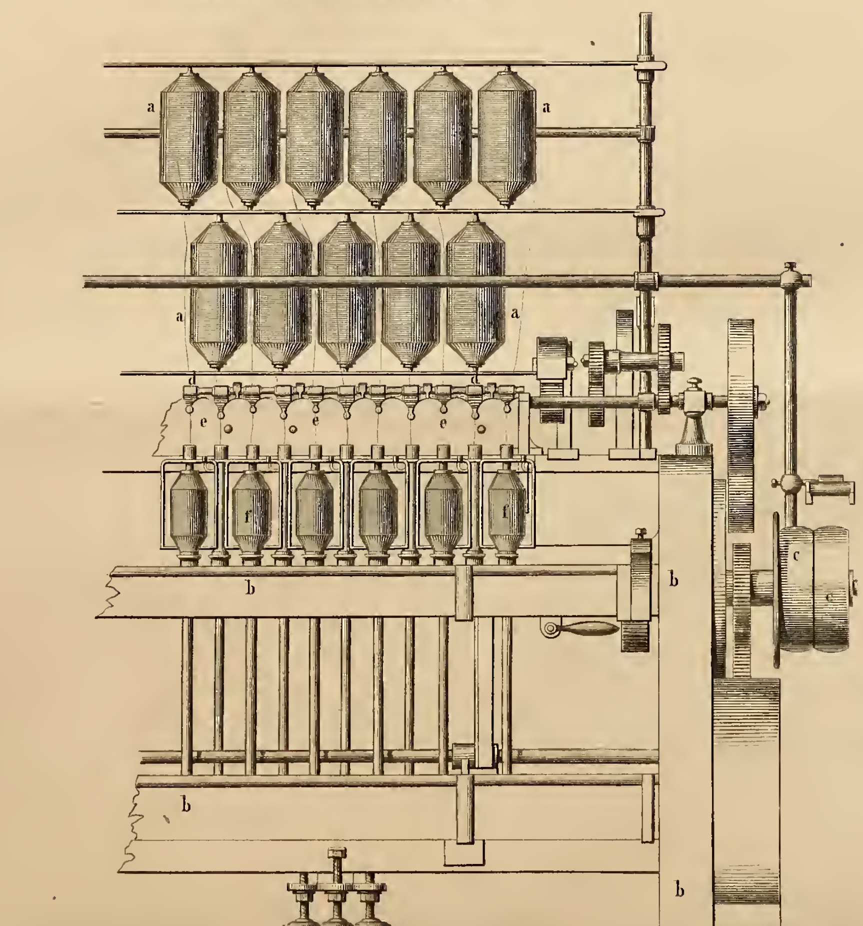
DESIGNS FOR ARTICLES OF UTILITY,

FROM THE 23RD OF SEPTEMBER, TO THE 12TH OF OCTOBER, 1852.

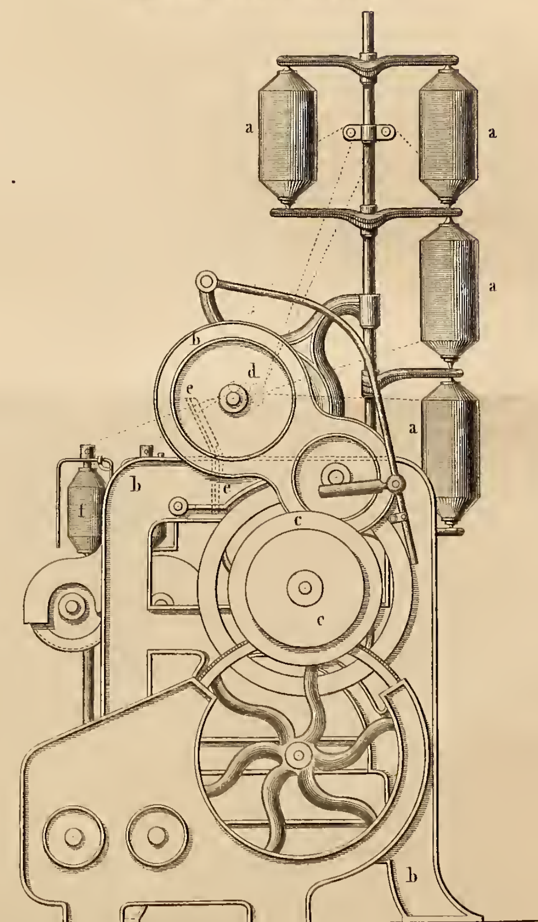
Sept. 23, 3375, Christopher Dam, Southampton, "Perpetual daily indicator."
„ 24, 3376, Samuel Whitfield and Jean Teychenné, Birmingham, "Bedstead convertible into ottoman and sofa."
„ 25, 3377, W. D. Hornsby... Great Bartholomew-close ....; Tbos. A. Burriage St. John's-square ....; John L. Barber... Cotton-mills, St. Martin's-lane.. "Netting-pattern type."
Oct. 2, 3378, Henry Stanbrough, Esq., Nutford-place, Edgeware-road, "Invalid table."
„ 12, 3379, A. Lyon and S. Middleton, 32, Windmill-street, Finsbury, "Seamless lithographic roller."

MASON'S
PATENT ROVING OR SLUBBING FRAME
FOR SOFT OR PRESSER BOBBINS.

FRONT ELEVATION.



END ELEVATION



SCALE ¾ INCH = 1 FOOT.

THE ARTIZAN.

No. XII.—Vol. X.—DECEMBER 1st, 1852.

EVENTS OF THE MONTH.

Before this sheet reaches the hands of the reader, nearly seven hundred inventors will have received provisional protection under the Patent Law Amendment Act, which has only been in operation since 1st October! What an idea does this fact give of the blighting influence which Deputy Chaffwax and his numerous red-tape progeny have hitherto exercised over the inventive genius of this country! If the directors of the Crystal Palace are wise, they will not miss the opportunity of securing the co-operation of some, if not all, of these inventors. If only half of them respond to the appeal to deposit models, such a collection would be a most interesting one. Indeed, there would be a peculiar fitness in inventors thus contributing to the attractions of that building which is the monument which commemorates that great national movement to which they are indebted, in a great measure, for their emancipation.

The month has not been suffered to pass unimproved by railway promoters. Several new schemes have appeared; the boldness of one of which has taken most people by surprise. It is the project of Mr. J. Samuel, C.E., and aims at nothing less than carrying a railway along the middle of the Thames, on piles, wide openings being left at intervals to allow the steamers and larger craft to cross. It is designed to run from London Bridge to Westminster, leaving the steamboats to take off the traffic at either end. The trains will have to be worked either by a rope or by atmospheric method; and it is stated that the bridges would not be interfered with, although the rails must be kept at a safe distance above high-water mark. This would relieve the river as well as the streets, and if well-lighted at night, would facilitate the ordinary navigation. Whether this plan or Mr. Pearson's will meet with the more favour, remains to be seen. It is admitted, at any rate, that *something* must be done to relieve the streets of London of the congestion of traffic.

In March, 1851, having a vision of the Great Exhibition before our eyes, we ventured to suggest to civic wisdom, that if New Cannon-street (which had then been begun a long time, and but very little progress made) were to have the houses within its limits cleared away at once, the street might be opened for traffic, and the new houses on either side built at leisure; that at the rate at which the road was being cleared, it would be some time in 1852 before the street was opened; and that, until that consummation, so devoutly to be wished for, took place, the street resembled a railway, which would be very valuable, if it only had a terminus. We hasten to acknowledge our error in over-appreciating civic energy—we should have said 1853!

If the questions are not impertinent, we should like to know when it is proposed that the street should be finished, and whether it is intended that all the heavy traffic, which will inevitably pour into it from London-bridge and Thames-street, is to be discharged at the narrow end of St. Paul's-churchyard, where the street debouches? If so, we suspect that the churchyard will prove very like a lobster-trap, which the fish creep into, but cannot get out of: and that Ludgate-hill will be twice as difficult to pass as it is at present, if such a thing can be possible. A glance at the map, or, what is better, a walk along the route, will show that the new street ought to have been carried through, in its full width, to Bridge-street, Blackfriars, which is of ample width, whilst a lane already exists which might have been widened, to form the greater portion of the street. This would have relieved Ludgate-hill of the heavy traffic; and the importance of making a distinction between slow and fast traffic does not appear to have yet occurred to our street improvers. Where there is only room for two lines of vehicles passing in opposite directions, it is obvious that a single slow vehicle will *prevent* all the rest from going any faster, If, therefore, the slow traffic could be mainly confined to one line of streets, the fast traffic would take the other; as, although it might be a little farther by distance, it would be much shorter in point of time, and a given-sized street would pass double the quantity of traffic that it does at present.

In fact, if the respective interests concerned could be induced to pull together, there would be very little difficulty in laying down a railway along Thames-street, Wapping, &c., to Limehouse, for the heavy traffic. Such a railway is in use in New York, where, we believe, it is worked by locomotives, which we do not contemplate, as, from the slow speed required, probably horses would be as economical and more convenient.

Another detail, which seems entirely neglected, is the improvement of the crossing points of the main thoroughfares—Gracechurch-street and Leadenhall-street form a notable case. Two immense streams of traffic are perpetually crossing one another at right angles; and the four corners of the junction are perfectly sharp. The removal of a house at each corner would effect an immense improvement, at a comparatively small cost. At present, the streams are alternately stopped, to allow of a passage in the transverse direction.

Mr. Pearson's scheme for making Farringdon-street the City railway terminus (*vide* p. 266, vol. 1851) seems to have secured sufficient support to render its adoption very probable.

We observe, that both the railway newspapers ridicule it, which is very natural, it being their bounden duty to run down anything which does not emanate from the magnates of the railway world.

Whatever may be the ultimate fate of this project, it has had the good effect of wakening up the companies, who, though they can see nothing good in Mr. Pearson's plan, will have no objection to try something on their own account. Thus the Great Western Company, finding that the "suburban residing" public have discovered that the two or three shillings spent in cab-hire, in getting up to Paddington, may be saved by going to Waterloo or London-bridge, have decided in going to Parliament for powers to effect a junction with the East and West India Dock Junction and Blackwall Railways, which would give them a terminus at Fenchurch-street.

The break of gauge, in this case, would militate very much against the transit of goods, whatever it might do as regards the passengers.

If all the junctions now talked of take place, it will be absolutely necessary to lay down two additional lines of rails on the Blackwall Railway, from Stepney junction to Fenchurch-street, as the trains are even now far too close one on the other.

BEET SUGAR MANUFACTURE,

WITH PLANS OF SUGAR WORKS, AS CONSTRUCTED BY M. DEWILDE, ENGINEER.

Translated for *The Artizan* from the French of M. Armengaud Ainé.

Illustrated by Plates 11 and 12.

(Concluded from page 213.)

THE introduction of the more improved processes for the extraction of the juice, the filtration through animal charcoal, the use of the vacuum pan, or of the tubular evaporators of Rillieux, appear indispensable to the existence of the colonial interests. By the aid of these improvements the colonial sugar growers have already effected improvements, which may be estimated as follows:—

Instead of 1 cwt. costing 14*s.* 9·75*d.*, they obtain 1·4 cwt., costing 16*s.* 11*d.*,* which reduces the price per cwt. to	£0	12	1
Carriage and loss	0	7	2·3
Commission, storage, tares, discounts	0	5	6
Duty	1	0	11·7
	£2	5	9
Selling price of fine sugar	2	8	8·1
Net profit	£0	2	11·1

We give also, on the authority of M. Lequince, a sugar manufacturer in the Departement du Nord, a statement of the labour employed in a factory, as well as the result of a day's work in the refinery. These figures show accurately the amount of the expenses, as far as the hand-labour is concerned.

Cost of hand-labour in a factory producing 5,700 cwt. of brown sugar, 1,968 cwt. of molasses, and 21,065 cwt. of pulp:—

Hand labour on 10,375 cwt. of beet-roots, produced from 284 acres of land, and comprising the cultivation, the seed, the weeding, the gathering of the crop, the burying in pits, the taking out, the bringing in, the scraping, the weighing, and, generally, all the hand-labour up to the rasping machine		£3305
Cost of labour in the sugar house		529
Add,		
590 cwt. of animal charcoal	£312	
1400 tons of coals	937	
Cloths, bags for pulp, &c.	184	
Oil and tallow	70	
Repairs	250	
Total	£1753	
Deduct expenses not chargeable to hand-labour	350	
		1403
Cost of labour to produce 5700 cwt. of brown sugar		£5237
Or about 18*s.* 4½*d.* per cwt.		

We now proceed to give the details of the wages expenditure in refinery which rasps 885 cwt. of beet roots, and produces 31·5 cwt. of sugar per 24 hours.

One foreman	£0	2	6
In rasping house.			
7 men, earning together	0	8	6½
13 boys, ditto	0	9	1
2 women, ditto	0	1	7
Carried forward	£1	1	8½
Defecating and skimming.			
Brought forward	£1	1	8½
4 men, earning together	0	5	0
1 boy	0	0	10
Clarifying and filtering.			
6 men, earning together	0	7	8½
Evaporating and boiling.			
2 men, earning together	0	3	4
Filling.			
3 men, earning together	0	3	9
Liquoring the sugars.			
5 men, earning together	0	6	3
2 boys, ditto	0	1	10½
2 women, ditto	0	1	7
Warehouses.			
2 men, earning together	0	2	11
5 women, ditto	0	3	9
Firing boilers.			
2 men, earning together	0	2	11
Wages of 57 work-people, who work for 12 hours	£3	1	7½
Wages of 114 ditto for 24 hours	£6	3	3
To be added, who work for the day only:—			
4 men, smiths, wheelwrights, and joiners	0	7	11
10 men at furnaces, for revivifying animal black	0	12	6
1 man, lamp trimmer	0	0	10
1 man, porter	0	1	8
1 man, book-keeper	0	4	2
3 women, sempstresses	0	2	3
Total wages for 24 hours	£7	10	11

The general presumption, based on the abolition of slavery in the colonies, is in favour of an extraordinary impulse being imparted to the home-grown sugar interest. The rise in price which has lately taken place seems to confirm this opinion.

* There is here an error of calculation in the original, by which the price is apparently reduced still lower.

ON THE EFFICIENCY OF HEATING SURFACE IN BOILERS.

WE have often endeavoured to impress upon our readers the importance of studying the question of the relative values of different kinds of heating surfaces; but we fear, that engineers in general are content to copy servilely the boilers of other makers, rather than institute a rigid course of experiment for themselves. We feel convinced that a boiler yet remains to be invented, which will be as superior to the present tubular boiler as that is to the old flue-boiler. Rich will be the reward of the inventor who can supply the want of a boiler which shall possess all the advantages of the locomotive boiler, without those faults which unfit it for the purposes of steam navigation.

The defects of this boiler, and of all the marine tubular class, are the immense number of stays required, and the difficulty of keeping the tubular heating surface free from deposit. These two leading defects, translated into commercial language, mean heavy first cost, and expensive maintenance. In addition to this, we must next inquire, "Of what value is the tubular heating surface obtained in these boilers?" An engineer says, complacently enough, "There are so many hundred feet of heating surface in this boiler." Although the question is rather "How many pounds of water will it evaporate per hour, and with how much fuel?" We have often been struck with the large evaporative power possessed by cylindrical boilers of small diameter, set over the fire, without any side flues or internal tubes, the draft passing directly to the chimney. Going a step farther, we find these same boilers, when united together, as in the "French" boiler (*vide* p. 260, vol. 1851), evaporating more economically, as regards *time* and *quantity*, than any

other boiler known. Most of our readers well know that Messrs. Hall, of Dartford, put these boilers to all their double-cylinder engines, and, as there is no secret about their productions beside good proportions and workmanship, we may fairly conclude that the economy for which they are celebrated is due as much to the boilers as to the engines. At any rate, the *duty done* by each square foot of heating surface in these boilers is much superior to that done by a square foot of surface in small tubes, as in a marine boiler.

The main difference in the *surface itself* is, that in one case a convex, and in the other a concave, surface is submitted to the action of the flame; and the advantage appears to rest with the former.

The reason of this appears to be, that the gases do not conduct heat by radiation, but by contact, and that *circulation of the gases*, therefore, is the only means of enabling the heating surfaces to abstract the heat from the gases. Hence, large tubes, through which the heated gases pass, cannot be the best form of heating surface; firstly, because the hottest gases will pass in an unbroken stream through the centre of the tube, leaving the cooler particles next the metal; and, secondly, because the lower semi-periphery of the flue is valueless as conducting surface. It is true that the economy obtained on the Cornish system appears to contradict this theory; but it will also be noticed, that in Cornwall a very slow draft is employed, which gives the heated gases *time* to give out their heat; and, hence, a larger and costly boiler is required to do a given quantity of work. It is well known in Cornwall that any attempt to hasten the draft causes a much larger proportionate consumption of fuel; and an attempt has been accordingly made to *break up* the current of heated gases passing through the large flue, by placing in the centre of it a generator, about half the diameter of the flue. This generator is supplied with water by a vertical pipe, connecting the front end of it, behind the fire-bars, with the bottom of the boiler flue, whilst an escape pipe for the steam generated within it is provided at the farther end of it, being led from the top into the steam space in the boiler. The generator, it may also be remarked, is prolonged until it reaches the back of the boiler setting; so that, by taking off a loose cover, it can be cleaned out without the trouble of going inside the boiler, or pulling down the brickwork.

In the description of the Cornish engine at the East London Water Works (by Mr. Wicksteed: London, J. Weale), the flue is shown 3ft. 10in. diameter, and the generator, 1ft. 9in.

As another proof of the low evaporative power of large tubes, when the draft is rapid, we may refer the reader to the statistics contained in Bartol's *Marine Boilers* (*ante*, p. 64), which show that, in a large number of boilers, constructed with tubes varying from 7 to 18in. in diameter, the evaporation is as low, on an average, as 6lbs. of water to 1lb. of coal. An example given (*ante*, p. 69) of the *Franklin*, is as low as 5lbs. of water.

The importance of breaking up and agitating the heated gases has been admitted by the best authorities, amongst whom we may mention Messrs. Bolton and Watt, who have constructed marine flue boilers, with stops in the flue, which consisted of a vertical water space, extending partly across the flue, and arranged alternately, right and left-handed, so as to throw the current of air against the sides of the flues. The same effect has been sought to be attained by hanging bridges of fire-brick, which throw the smoke up and down, and cause a reverberation of the flame.

Mr. Baker's (American) arrangement appears to be of this description (*vide* p. 120, vol. 1849), and, according to Mr. Wicksteed's report, he succeeded in saving 11·8 per cent. of fuel at the East London Water Works, which may be taken as equivalent to 20 per cent. in ordinary boilers, where the economy has not been pushed so far to begin with.

Mr. Overman, the eminent American engineer (in his "*Mechanics*"), strongly supports this theory, and proposes, in setting cylindrical land boilers, to carry the flame up a series of side flues, which unite above the boiler in a channel or flue common to the whole. The top of the boiler is, of course, protected from the heat by a covering of fire-brick. He says, "Tubes or other vessels containing water must be placed so that the hot gases play around the outside. If we lead a current of air around a cylinder, we may observe that a particle of air plays but a short time on its surface, when it gives way to another. This experiment may be easily tried by putting a pipe in a strong draft of air, in which a little dry flour is diffused; we see then that, after a particle of the flour touches the pipe once, it is thrown off from it, to make room for the next following particle. The particles play almost all around the cylinder, and a concentration, or increase of density, behind the pipe, is the consequence."

We have quoted Mr. Overman *verbatim*, but his expression, "behind the pipe," may mislead the reader. That side facing the current is meant, which we should rather term the front of the pipe.

It is observed, in the American boilers with vertical water-tubes, that at the side of the pipe not exposed to the current, a tail of soot is collected; and it has been suggested to us by an eminent practical authority, that this might be avoided by making the back of the pipe of that shape, to which the soot would not adhere. The convenience, however, of having the pipes circular, would probably counterbalance any advantage to be gained by such an expedient.

From the various arguments here recapitulated, we infer, that the course which improvement must follow will be the putting the water into the tubes, and not the heated gases.

To combine the numerous requisites of a good marine boiler, viz., lightness, strength, facility for cleaning out and repairs, and the condensation of the requisite quantity of heating surface into a small bulk, with this condition, is no doubt a difficult problem; but it is one which will pay for the solving—and that is the test for all things in this utilitarian age.

ON THE ECONOMICAL APPLICATION OF HYDRAULIC POWER.

We are not about to advocate the more extended application of water power in this country, for reasons which we will presently notice, but, on behalf of our colonies, where we have many readers, we feel bound to notice any plans which promise to be of advantage to them.

With regard to the economy of water power, we entirely agree with the opinion expressed by a writer in the *Times*, that, in a thickly populated country like England, the saving of coals and capital invested in steam power is usually far more than counterbalanced by the loss arising from the imperfect drainage of the land, forming the watershed of the stream. The immense improvement effected by good drainage is evident, not only in its increasing the productiveness of the land, but also in its rendering the harvest time more early, and thus securing the crop against many of the accidents to which, in bad seasons, it is liable. When it is considered how many thousand acres of valuable land are often deteriorated for the sake of keeping some jog-trot old water-mill going, it is manifestly the interest of the landowners to combine, and seek to extinguish the rights of water-power, wherever, from the termination of leases, or the decay of structures, it is practicable to do so with economy. To the reasons already urged, may be added the sanitary improvement which never fails to follow perfect drainage. In our colonies, however, the case is different—abundance of water power, the scarcity of capital to erect expensive machinery, and the cheapness of land, combine to render the proper application of water power a subject of the highest importance.

As the paddle wheel is being superseded by the screw propeller, so is the cumbrous water wheel giving place to its "re-actionary" rival, the turbine, which appears a convenient generic name, under which may be

included all that numerous family in which the reacting power of the water is utilised.

The person to whom we are most indebted, in this country, for developing the advantages of the reaction wheel, is, undoubtedly, Mr. James Whitelaw, whose experiments are recorded in the *Artizan* 1846-7-8, and 9. At page 760 of the latter volume will be found a detailed drawing of the most approved form in actual use, with an account of its performance. On the continent the turbine has long been regarded with favour, and we have evidence, that in the United States it is being very extensively used. If our own colonies have not also availed themselves of this motor, we believe it to be chiefly owing to the fact, that no English engineers have thought it worth while to manufacture them as a marketable article, like portable steam engines. With the present stream of emigration to the colonies, we believe the time has arrived when turbines would sell as well as gold-washing machines or corrugated iron houses, and we commend the subject to the attention of some of our enterprising export firms.

The peculiar advantages of the turbine are the high speed imparted to the shaft, and its power of working in back water. The first of these properties admits of the shaft of the horizontal turbine being applied directly to mill-stones, whilst for saw mills or blowing engines, the vertical form represented in the accompanying engraving is peculiarly convenient. These are in use in the United States, and Mr. Overman (in his *Mechanics for Millwrights, &c.*) says—"This wheel will work in back water as well as when free from it, and uses the water to better advantage than the common wheel. If a vertical reaction wheel is to be used, this form of wheel has a decided advantage over any other description."

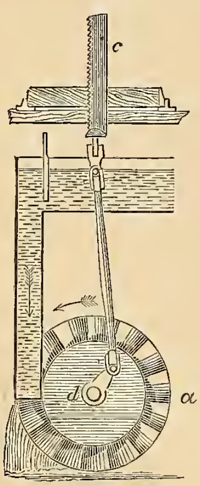


Fig. 1.

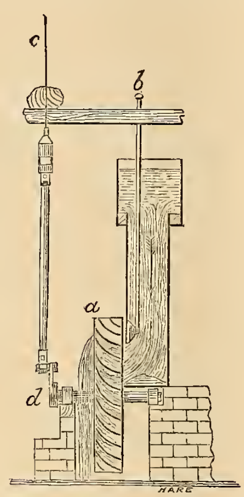


Fig. 2.

Its construction will be readily understood from the sketch. Fig. 1 is a side view, and fig. 2, an end view of the turbine, as applied to drive a saw; *a* is the wheel furnished with curved arms, and receiving a supply of water from the penstock above; *b* is the sluice for adjusting the supply to the wheel; *c* is the saw, the frame of which is connected by a wooden connecting-rod to the pin of the crank, *d*, on the shaft of the wheel. In this manner a high speed is communicated at once to the saw without any gearing, the whole forming the cheapest saw mill that we are acquainted with. Another variety of wheel may be also constructed, by enclosing it in a box, and allowing the water to enter at the periphery and escape at the centre.

We have often been surprised that none of our Cornish engineers have turned their attention to this class of motors, as many of the water-wheels have cost a large sum of money, and there is a large quantity of sawing to be done for the supply of the mines.

COTTON AND ITS MANUFACTURING MECHANISM,

By Robert Scott Burn, M.E., M.S.A.

Illustrated by Plate 16.

(Continued from page 214).

Having described the operation of the "drawing-frame," we have now to proceed to that of the "roving, or slubbing-frame." This machine is designed to give to the attenuated slivers, or drawings, a certain degree of cohesion, to enable them to be wound upon a bobbin. This is effected by giving them a slight twist; but as, in the after process of making the cotton into a hard spun thread, this twist has to be taken out, to allow of the still further attenuation of the cotton sliver by passing between the rollers in the "throstle," the degree of twist given in the roving-frame must only be sufficient to keep the sliver together, and admit of its being regularly unwound from the bobbin. The twisting of the sliver, and the winding of it on the bobbin, is generally effected by what is termed the "bobbin and fly." For an explanation of the principle of this contrivance, we beg to refer our readers to the article on "Flax and its Manufacturing Mechanism," in the number for October, 1851, page 220. We propose, in our next, to give ample descriptions, illustrated by detail drawings of the various movements, and the mechanism by which they are carried out. In the meantime, we content ourselves with describing very briefly the arrangement of the machine in working order, two views of which are represented in plate xvi., consisting of front and end elevations. The general framing is shown at *b b*, motion being given to the various parts through the fast-and-loose pulleys, *c c*. Bobbins, *a a*, are inserted in the framing, so as to allow of their easily revolving. The bobbins and flys, *f f*, revolving at a great speed, withdraw from the surface of the bobbins, *a a*, the requisite quantity of roving. Previously to being wound upon the bobbin, *f f*, the roving is made to pass between the sets of drawing-rollers, *d d*, by which it is still more attenuated. It is necessary to note, that the manner in which the bobbins, *a a*, are produced is by a machine used previously to the one now shown; but the slivers from the drawing-frames are withdrawn from the *cans*, placed at one side of the machine, passed through the drawing-rollers, and wound upon large bobbins, at *a a*, which are taken off the machine (in plate xvi.), and finally wound upon bobbins of a smaller size.

ON THE COMPARATIVE ECONOMY OF CONDENSING AND NON-CONDENSING ENGINES.

(Concluded from p. 240.)

It is a known law that gases expand about $\frac{1}{480}$ part for every degree of increase in their temperature; and if confined, instead of expanding $\frac{1}{480}$ part, the pressure in the vessel by which it is contained will be increased $\frac{1}{480}$ part.

Now, returning to the foregoing supposition, the 55·4 degrees of heat, added to increase the pressure to 40 lbs., acts in two ways: first, by an increase in the density of the steam by the evaporation of more water; secondly, by increasing the temperature of the steam.

According to this law of the expansion of gases by heat, increasing the temperature of the steam must increase the pressure that is already produced by the increase of its density $\frac{1}{480}$ part for every degree that the temperature is increased. Let us now see what will be the result of this mode of reasoning at three different pressures—say at 40 lbs., 60 lbs., and 100 lbs.

As stated before, the pressure at a temperature of 268·4 degrees is 40 lbs.; but if the pressure were only in proportion to its density, it would be but 36·9 lbs.; and to increase the pressure from 15 lbs. to 40 lbs., there has been an addition to the temperature of 55·4 degrees; therefore, $\frac{36{\cdot}9 \times 55{\cdot}4}{480} = 4{\cdot}26$ lbs. increase in the pressure; and 36·9 + 4·26 = 41·16 lbs. instead of 40 lbs., or a difference of 1·16 lbs.

At the temperature producing a total pressure of 60 lbs., the pressure would be only 53·5 lbs., if it were in proportion to the density, and the addition to the temperature above that of 15 lbs., or the pressure of the atmosphere, is $294{\cdot}1-213=81{\cdot}1$ degrees; therefore, $\frac{53{\cdot}5\times 81{\cdot}1}{480}=9{\cdot}04$ lbs. increase of pressure; and $53{\cdot}5+9{\cdot}04=62{\cdot}54$ lbs. pressure, instead of 60 lbs., the real pressure, or a difference of 2·54 lbs.

At the temperature producing a total pressure of 100 lbs., were the pressure in proportion to the density, it would be but 85·3 lbs., and the addition to the temperature above that of 15 lbs., is $329{\cdot}6-213=116{\cdot}6$; thence, $\frac{85{\cdot}3\times 116{\cdot}6}{480}=20{\cdot}7$ lbs. increase of pressure, and $85{\cdot}3+20{\cdot}7=106$ lbs. or a difference of 6 lbs.

We are of opinion that the discrepancies existing between these results and the actual pressures may be fairly attributed to an incorrectness in the elements of, and not to the principles embodied in, the calculations, as a very slight difference between the given temperature, or volumes for any pressure, and the actual temperature or volumes, would be sufficient to correct those discrepancies; or the fraction given as the expansion of gases for each degree the temperature is increased, viz., $\frac{1}{480}$ part, may not be the *exact* expansion; and where the temperature is increased so many degrees, as in the foregoing cases, it would sensibly affect the result.

We conceive, however, that these results approximate sufficiently near the actual pressure to show the principles to be correct upon which the calculations are founded.

We now come to the second reason assigned for the economy of high-pressure engines, viz., "the superior economy in the consumption of steam by the engine when used at a high-pressure instead of a lower one."

This arises from the fact that the total amount of losses from the pressure of the atmosphere, friction, or other causes, does not increase in the same ratio as the effective pressure of the steam acting upon the piston, but is nearly a constant quantity; consequently, the greater the pressure of the steam upon the piston, the smaller will be the ratio between the sum of the losses and the whole force exerted.

In order to show this clearly, we will compare the results produced by a non-condensing engine, working under two different pressures, say with pressures above the atmosphere of 20 lbs. and of 80 lbs., or total pressures of 35 lbs. and of 96 lbs., per square inch upon the piston, and thus exhibit the ratio between the losses and the whole force exerted by the different pressures. But, to be able to accomplish this, we must first determine the amount of the losses in each case.

The items of loss, when working under a pressure of 20 lbs. per square inch above the atmosphere, we will suppose to be—

Press of atmosphere, per square inch.. ..	15·00 lbs.
Power required for working valves	0·50 „
„ „ „ pumps	0·50 „
Friction of piston	1·00 „
Friction of journals and other working parts..	3·50 „
Total amount of losses..	20·50 lbs.

Now, 20 lbs.+15 pressure of atmosphere = 35 lbs.; and 35·00—20·50 lbs.=14·50 lbs. pressure, the whole effective force exerted per square inch upon the piston by the engine, and being 41·4 per cent. of the whole power upon the piston.

The total amount of losses, when working under a pressure of 80 lbs. per square inch above the atmosphere, is but little greater than when the pressure is but 20 lbs. above the atmosphere; for it is evident that the principal item of loss, which is the pressure of the atmosphere, is the same in both cases; and the increase of friction of the piston, journals, &c., is but trifling. The items of loss will then be—

Pressure of atmosphere per square inch ..	15·00 lbs.
Power required for working valves	2·00 „
„ „ „ pumps	2·00 „
Friction of piston	1·50 „
Friction of journals and other working parts ..	4·50 „
Total amount of losses	25·00 lbs.

Thence, 80 lbs.+15 lbs. pressure of atmosphere = 95·00 lbs.; and 95·00 −25·00 = 70·00 lbs. pressure per square inch, the whole force exerted upon the piston, by which a useful effect is produced, being 73·7 per cent. nearly of the whole force upon the piston.

Thus, theoretically, there is 32·3 per cent. more power usefully applied, when working at the higher than at the lower pressure, but practically the difference is not so great as here represented, as there is almost necessarily a greater loss from leakages, and greater radiation of heat from pipes, cylinders, &c., when working at the former than at the latter pressure.

Having thus, as we think, satisfactorily shown not only that it is more economical to generate steam of a high pressure than a lower one, and also to use it at a high pressure in working non-condensing engines, but that there is some given pressure at which, if used in non-condensing engines, it will render them equally economical with the ordinary condensing engine used in the English practice, we will endeavour to ascertain what that pressure should be, supposing the steam to be worked at its full pressure during the whole length of the stroke of the engine. For the condensing engine we will assume as the working pressure 5 lbs. per square inch above the atmosphere, or a total pressure of 20 lbs. per square inch. The items of loss in this engine will be—

Imperfect vacuum, per square inch	2 25 lbs.
Power required for working valves	0·50 „
„ „ „ pumps	0·75 „
Friction of piston	0·40 „
Friction of journals and other working parts ..	2·25 „
Total amount of resistances in condensing engine	6·15 lbs.

By reference to the fourth column of the table given in the first part of this article, it will be observed that, by assuming the fuel required to maintain the steam at the pressure of the atmosphere at 100 parts, the amount required to maintain the steam at 20 lbs. will be 130 parts.

Now, the total pressure upon the piston is 20 lbs., and the total amount of resistance is 6·15 lbs.; thence, 20 lbs. − 6·15 lbs. = 13·85 lbs. pressure per square inch as the available power: this is obtained at an expense of 130 parts of fuel; thence, $\frac{130}{13{\cdot}85}=9{\cdot}38$ parts of fuel, to obtain 1 lb. pressure per square inch available power upon the piston.

Our object now is to find at what pressure per square inch it is necessary to maintain the steam for a non-condensing engine, so that each 9·38 parts of fuel will produce 1 lb. pressure per square inch upon the piston available power. This will be found to be 60 lbs. total pressure, or 45 lbs. pressure above the atmosphere, as the following calculation will show. The items of loss may be estimated thus:—

Pressure of atmosphere per square inch ..	15 00 lbs.
Power required for working valves	0·90 „
„ „ „ pumps	0·90 „
Friction of piston	1·20 „
Friction of journals and other working parts..	4.00 „
Total amount of resistances	22·00 lbs.

The whole pressure upon the piston is 60 lbs. per square inch, and the

whole amount of resistances is 22 lbs. per square inch; thence, 60 lbs. -22 lbs. $= 38$ lbs. pressure per square inch available power, which is obtained, as will be seen by reference to the fourth column of the table, by an expenditure of 357 parts of fuel; then $\frac{357}{38} = 9{\cdot}39$ parts of fuel for each pound available pressure per square inch upon the piston.

It would thus appear, that by working a non-condensing engine with steam of a pressure equal to 45 lbs. per square inch above the pressure of the atmosphere, the expenditure of fuel in proportion to the available power is nearly the same as in working a condensing engine with a pressure of steam equal to 5 lbs. per square inch above the pressure of the atmosphere.

But this pressure is only *theoretically* equal in economy of fuel to the condensing engine; practically, a pressure would be required somewhat greater, from the loss by leakages, radiation of heat, &c., being greater in the non-condensing than in the condensing engine.

We believe that every engineer who has had experience in working both classes of engines is fully satisfied of the truth of the proposition set forth in the commencement of this paper, viz., "that a non-condensing engine may be worked with steam of some given pressure per square inch that shall equal in economy the ordinary condensing engine used in the English practice."

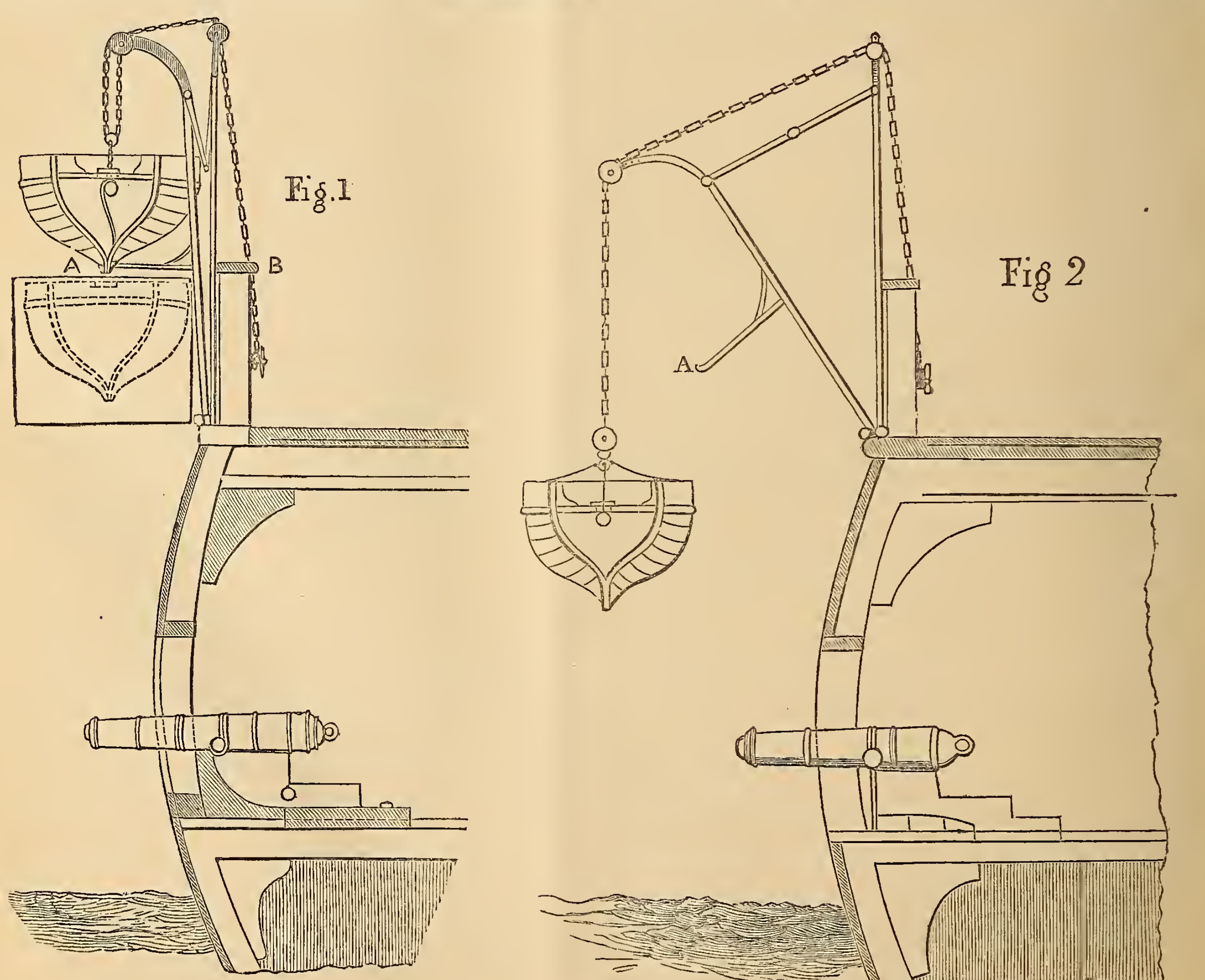
Our object has been to give some satisfactory explanation why this is the case; and in attempting to do this we will not pretend that the items of resistance given for each description of engine are precisely correct, as we have stated them according to our judgment, having no experiments to refer to from which to arrive at their precise amount; neither do we pretend that the calculations are made with mathematical accuracy, as our purpose did not require it; but if any of the principles and reasonings here advanced, upon which these calculations are based, are incorrect, or founded upon incorrect premises, we should be as much gratified to see them disproved as any one; our only object being to arrive at a correct exposition of the fact.

New York, Oct. 29th, 1840. C.

RUSSELL'S PATENT METHOD OF LOWERING SHIPS' BOATS.

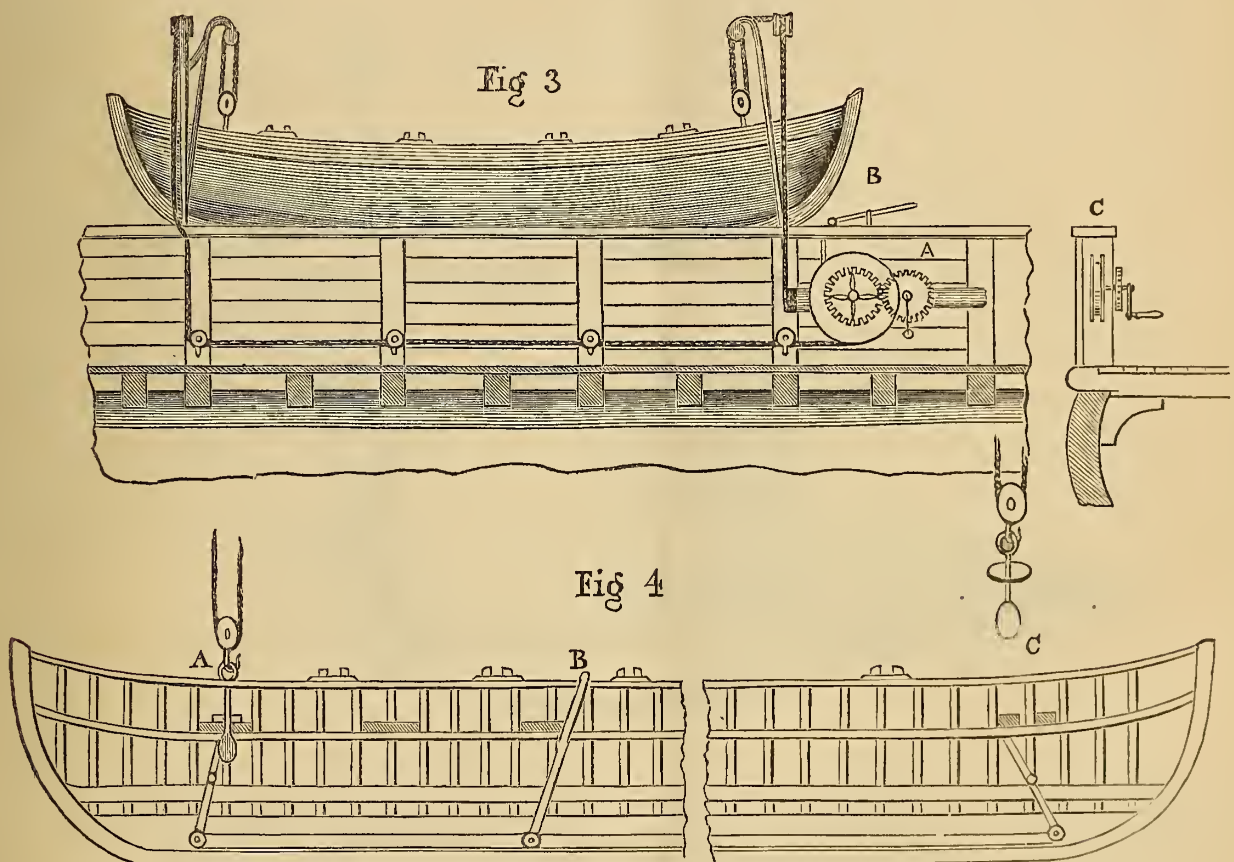
The numerous fatal accidents which have occurred from the inefficient manner in which the lowering and raising of ships' boats is usually provided for, have been the means of drawing so much public attention to the subject, that we are not surprised that several candidates have appeared for the reward which would inevitably follow any perfectly satisfactory plan. The plan of Mr. Russell, delineated in the accompaning engravings, appears to us well calculated to fulfil the end in view.

The boat is hung on two derrick cranes, which have supporting



stancheons on the bulwarks. Fig. 1 is a transverse section of part of the ship's side, showing the boat resting on the cranes, A, and fig. 2 shows the boat swung off and partially lowered. From the radial action of the derricks, it will be seen that the boat clears itself the *moment it is begun to be lowered, without hoisting it up at all.* The most inexperienced person can imagine that, when a ship is on fire, and everything in confusion, it is vain to expect that the few men who retain their presence of mind can hoist a heavy boat out with the same coolness that they should possess if their power is to be united. The removal of the necessity for hoisting the boats at all is, therefore, an important feature in this plan.

Fig. 3 is a longitudinal elevation of the inside of the bulwarks, showing the method of leading the ropes by which the boat is raised and lowered. A winch, A, fig. 3, serves to give power to raise the boat, and is provided with a break, B, fig. 3, by which the lowering is safely effected. A rope may be attached to the brake-handle, so that not a single man need be left on board the ship to attend to the brake. As both ropes by which the boat is hung lead to one barrel, the two ends of the boat must be raised or lowered simultaneously.



In order to effect a simultaneous disengagement of the ends of the boat, when she touches the water, the blocks are made fast to two bolts (see fig. 4), which have ends swelled out, and taking into pieces provided in the boat for that purpose. These are held in place by two levers, which are connected together by a rod running along the bottom of the boat, and commanded by a handle in the centre, by moving which the blocks are simultaneously disengaged. A, fig. 4, shows the block attached; C shows it cast loose, and B is the handle by which it is effected.

EFFECT OF SIZE OF VESSELS ON THEIR SPEED.

To the Editor of the Artizan.

Sir,—Allow me to correct an error in your number of September last (p. 208), regarding the "Effect of the Size on the Speed of Vessels" from Mr. Bourne's *Treatise on the Screw Propeller.* Mr. Bourne grounds his calculations on "What would be the speed that would be attained by a vessel of the same form as the *Fairy*, and the same proportion of power to tonnage, but three times the length, and, consequently, of nine times the area of immersed section, twenty-seven times the capacity, and nine times the power?" and he concludes, "that with 1,080 horse power, the speed of the large vessel would be increased in proportion to the square root of one to the square root of three, or that the speed of the large vessel would be 1·73 times that of the small vessel; and if, therefore, the speed of the *Fairy* be 13 knots, the speed of the large vessel would be 22·49 knots, although the proportion of the power to the sectional area is in both vessels precisely the same." Now, the error in the calculation that I wish to point out is this: that the speed of the large vessel with twenty-seven times the capacity and with only nine times the power of the small vessel would only be 13 knots, or the same as that of the small vessel, and not 22·49 knots as stated. As the ratio of power to the immersed section of the vessels is, in both cases, precisely the same, it follows, that the speed of those vessels would also be the same, but the relative advantage of the large vessel would be the gain of three times the capacity over the small vessel, with the same ratio of power to immersed section, and the speed in both vessels would be the same; but if this ratio of power be valued to the capacity of the large vessel, it would then only be one-third of the

relative power of the small vessel for an equal speed. If, now, the power in the large vessel be increased in the same ratio as the power to the capacity of the small vessel, it would then require twenty-seven times the power of that vessel, or 3,240 horse power, and the speed would be increased in the ratio of the cube root of one to the cube root of three; that is, the speed of the large vessel would be 1·44 times 13 knots, or 18·72 knots instead of 22·49 knots. It should further be observed that, in supplying the large vessel with the same ratio of power to capacity as in the small vessel, there would be nothing gained in increased capacity of the large vessel, but the advantage would be an increase of 1·44 times the speed. Thus, in either case, the large vessel would have the advantage over the small one, either in speed or capacity, but it could not have both of those advantages at the same time, without sacrificing something of one or the other of them.

It would not have been necessary for me to point out this error to Mr. Bourne—who knows too well the resistance of a vessel—but as errors will happen sometimes, he will no doubt excuse me for pointing them out, as I have no other motive than that the thing should be right; and an error of this kind accepted uncontradicted might lead some persons to hope for advantages that could not (at least by the present mode of fitting out vessels) be realised.

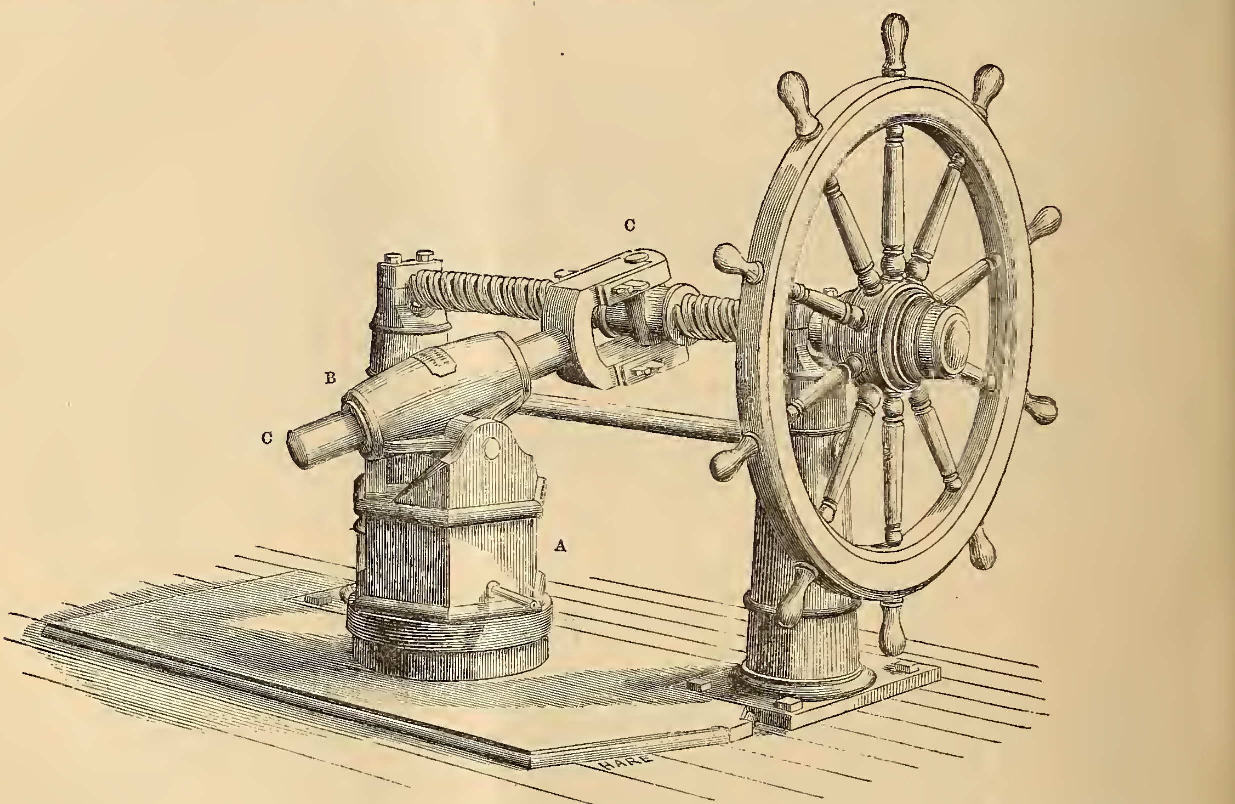
Very respectfully, your most obedient servant,

London, Nov. 1, 1852. C. A. HOLM, C.E.

[We give insertion to the foregoing from a very able and ingenious correspondent, but we are of opinion that, if Mr. Holm had formed his judgment from Mr. Bourne's work itself, instead of from the brief extract we gave from it, he would have acquiesced in Mr. Bourne's conclusion. The difference we take it to be this:—Mr. Bourne computes what the speed of the *Fairy* would be if her scale were enlarged until she had nine times the present immersed sectional area, and nine times the power, and he finds that the speed would be very much increased; Mr. Holm replies that this must be an inadvertence, inasmuch as the speed of a vessel of a given form is determinable by the proportion of power per square foot of immersed section; a fact of which Mr. Bourne could not but be cognisant. Now, the fact is, that Mr. Bourne lays down this law as the one generally accepted for determining the speed of vessels, but at the same time he says that it is erroneous, and he propounds another law, which he says gives results more conformable to experience. According to this new law, the size of the vessel—all other things being the same—materially influences the result, and that this is so is a fact well known to those conversant with yacht races, where an allowance is always made for size. Mr. Holm computes according to the received hypothesis, whereas Mr. Bourne has shown that hypothesis to be untenable, and he therefore discards it in favour of another which is more consistent with fact.]

ROBINSON AND GREEN'S PATENT STEERING APPARATUS.

An efficient steering apparatus, which should combine the requisites of strength and simplicity, has long been a desideratum. If ever it has been arrived at, we believe it is in the case before us, for this apparatus possesses a qualification which we have in vain looked for in all other machines—that is, the rise and fall of the rudder does not affect the working of, or injure, the machine. The working parts consist, as will be seen from the accompanying perspective view, of a treble-threaded screw; the motion of the nut of which is conveyed through a lever to the rudder-head, and the connections are made by swivels in such a manner as to allow of motion in all directions. A is the cap of the rudder-head, on which a cast-iron socket, B, is hung on trunnions, so as to swivel. Through this socket slides the lever, C C, the upper end of which holds, on a swivel, the nut of the screw, moved by a steering wheel in the ordinary manner. As one end of the lever, C, moves in a straight line, whilst the socket describes a circle, it is obvious that a longer leverage is obtained when the helm is hard over, than when it is amid-ships; and thus the steersman has greater power over the helm just at the moment it is most required.



This apparatus has been applied to two vessels with perfect success.

DIMENSIONS OF FRENCH LOCOMOTIVES.

Au Rédacteur de l'Artizan.

Monsieur,—Croyant qu'il peut être interessant pour vos lecteurs de connaître quelques détails sur les locomotives en France, je vous envoie leurs dimensions que j'ai réduites en mesures Anglaises de l'ouvrage de M. Armengaud, intitulé *Publication Industrielle*, pensant que vous n'hesiterez pas à les mettre dans votre estimable journal, qui dans notre contrée, possède un si grand crédit pour toutes les informations sur la mécanique pratique.

Havre, 1852. Albert Nillus.

Crampton's patent locomotives, as executed by Messrs. Derosne, Cail, and Co., of Paris, are in use on many of the French lines, particularly on the northern and the Strasburg Railways; on the former of which they perform the service at the rate of 56 miles per hour. The dimensions given are those of the various classes actually in use on the northern line.

Principal Dimensions of the Locomotive Engines employed on the Northern Railway of France.	Crampton's Patent Engines.	Passengers Train Engines.	Goods Engines.
	ft. ins.	ft. ins.	ft. ins.
Diameter of cylinder	0 15·98	0 14·96	0 14·96
Length of stroke	1 10·04	1 10·04	2 0
Diameter of driving-wheels	6 10·67	5 8·97	4 0
Proportion of speed of wheels to pistons	6·6 : 1	4·71 : 1	3·14 : 1
Diameter of leading wheels	4 5·14	3 3·37	4 0
Diameter of trailing do.	4 0	3 3·37	4 0
BOILER.			
Length inside fire-box, upper part	4 4·96 4 5·94	3 0·42	3 0·42
Breadth, lower part	3 3·96 3 5·53	2 11·98	2 11·98
Length outside	5 1·023	3 8·29	3 8·29
Breadth outside	4 1·02	3 7·46	3 7·46
Width of spaces, extreme .. above	0 4·04	0 3·94	0 3·94
Width of spaces, extreme .. below	0 3·54		
Width of spaces at side	0 3·94	0 3·74	0 3·74
Total height inside fire-box	4 5·54	4 6·34	4 6·34
Outside diameter of barrel of boiler..	3 3·37	3 2·19	3 2·19
Length of cylindrical part between the plates	11 7·76	12 1·08	12 1·08
Length of tubes	11 7·76	12 1·08	12 1·08
Number of do.	178	125	125
Outside diameter, which is reduced to 1·81 inches at fire-box end	0 1·97	0 1·93	0 1·93
Inside diameter of do.	0 1·81	0 1·77	0 1·77
Distance from centre to centre ..	0 2·56	0 2·44	0 2·44
Outside length of smoke-box	4 1·01	3 9·96	3 9·96
Breadth over the plates	2 0·92	2 6·31	2 9·98
Total length of inside boiler over fire-box	18 8·80	19 0·35	18 7·35
Thickness of copper plates of fire-box	0 0·47	0 0·43	0 0·43
Thickness of tube plate across tubes	0 0·98	0 0·9	0 0·9
Thickness of plates in boiler barrel..	0 0·39	0 0·39	0 0·39
Thickness of plates of shell of fire-box	0 0·47	0 0·47	0 0·47
Do. do. tube plate (iron)	0 0·59	0 0·59	0 0·59
Do. do. smoke-box ..	0 0·39	0 0·31	0 0·31
Height from bottom of fire-box to cylindrical part	1 8·08	1 10·15	1 10·15
Height from do. to lower part of dome	5 9·09	7 8·20	7 8·20
From top of rail to bottom of fire-box	0 11·81	1 7·80	1 3·75
From do. to cylindrical part	2 7·89	4 0·02	3 7·72
From top of rail to top of chimney..	13 1·48	13 1·48	13 1·48
Height of cylindrical part above driving-axle	0 9·45	1 2·96	1 7·88
Outside diameter of the chimney .. .. top	1 2·64 1 2·17	1 1·39	1 1·39
Outside diameter of the chimney .. .. bottom	1 4·22 1 5·72		
Thickness of chimney	0 0·24	0 0·24	0 0·24
Height of chimney above smoke-box	6 4·57	5 7·32	5 11·06

Principal Dimensions of the Locomotive Engines employed on the Northern Railway of France.	Crampton's Patent Engines.	Passengers Train Engines.	Goods Engines.
	ft. ins.	ft. ins.	ft. ins.
Direct heating surface in fire-box, in square feet	103·65	0 55·11	0 55·11
Heating surface in tubes	1010·5	715·8	715·8
Total heating surface	1114·15	770·91	770·91
Space available for steam, in cubic feet..	35·31	33·93	33·93
DIMENSIONS OF FRAMING.			
Length from end of foot-plate to fire-box	1 3·74	1 3·74	4 6·92
Total length on exterior of boiler ..	18 3·68	18 6·83	18 8·80
Length from smoke-box to end ..	0 9·84	0 9·84	0 4·92
Total length	20 5·26	20 8·41	23 8·64
Depth of framing	0 9·84	0 7·87	0 7·87
Thickness of framing	0 0·98	0 1·18	0 1·18
Height of upper part of do. above rails	3 8·88	4 1·8	3 5·73
Height of do. above driving axle ..	2 11·43	1 4·73	1 5·71
Distance between centre of frames ..	4 2·0	4 0·26	4 0·26
Distance between fire-box and hind axle..	0 9·05	0 5·11	0 4·72
Distance between hind axle and driving axle..	8 4·39	4 11·25	4 0·32
Distance between driving and leading axles	6 4·77	5 2·99	5 3·97
Distance between leading axle and smoke-box	1 2·96	1 9·26	2 1·69
Total equal to the length of the boiler barrel	11 7·76	12 1·07	12 1·07
Breadth of tires..	0 5·51	0 5·51	0 5·51
Thickness of do. at middle	0 1·96	0 1·96	0 1·96
No. of arms in driving wheel	20	16	12
Diameter of seat of the driving wheels	0 7·87	0 7·08	0 7·08
Thickness of boss of driving wheels..	0 7·71	0 7·48	0 7·08
Diameter of journals of driving axle	0 6·49	0 6·30	0 6·30
Length of journals of do.	0 10·23	0 5·9	0 5·9
Diameter of body of shaft	0 7·28	0 6·10	0 6·10
No. of arms in leading and trailing wheels	14 12	10	12
Diameter of seat of do.	0 9·05	0 6·30	0 7·08
Thickness of boss of do.	0 7·48	0 6·89	0 7·08
Diameter of journals of do.	0 6·10	0 5·51	0 7·08
Length of journals of do.	0 11·81	0 6·30	0 5·90
Diameter of body of axle..	0 7·08	0 5·31	0 5·70
CYLINDER, CONNECTING ROD, &c.			
Thickness of piston	0 4·33	0 4·25	0 4·52
Do. at edges	0 0·78	0 0·98	0 0·98
Length of the cylinder between the covers	2 3·17	2 3·28	0 2·52
Diameter of piston rod	0 2·36	0 2·16	0 2·16
Length of guides (steel)	0 4·33	0 3·15	0 3·15
Thickness of guides at extremities ..	0 1·57	0 1·3	0 1·3
Thickness of guides at middle	0 1·96	0 1·89	0 1·89
Length of connecting-rod..	8 0·65	4 6·13	4 9·87
Diameter of crank-pin journal	0 4·52	0 4·25	0 3·15
Length of do.	0 4·48	0 3·54	0 3·54
Distance from centre of cylinder to centre of frame	0 11·96	0 13·03	0 16·74
Distance between centres of cylinders	6 1·93	6 2·33	6 9·73
Do. backing eccentrics	7 1·35	2 10·29	2 10·29
Do. forward eccentrics	7 5·76	3 2·85	3 2·85
Do. centres of slide-rods	7 3·32	3 0·57	3 0·57
Travel of eccentrics	0 4·72	0 4·56	0 4·56
Inside diameter of do.	0 8·81	0 12·20	0 12·20
Outside do.	0 9·76	0 12·59	0 12·59
Angle of fixing do.	35°	30°	30°
Width of eccentric bands	0 1·98	0 2·26	0 2·26
Thickness of do.	0 1·57	0 1·61	0 1·61
Eccentric-rod, length between centres	4 7·12	4 6·73	3 7·93

Principal Dimensions of the Locomotive Engines employed on the Northern Railway of France.	Crampton's Patent Engines.		Passengers Train Engines.		Goods Engines.	
	ft.	ins.	ft.	ins.	ft.	ins.
SLIDES VALVES.						
Lengtb of openings	0	11·41	0	9·84	0	9·84
Inside distance apart	0	5·23	0	4·48	0	4·48
Length outside	0	10·82	0	9·68	0	9·68
Deptb inside	0	2·36	0	2·36	0	2·36
Cylinder face, exhaust-port	0	3·74	0	2·99	0	2·99
Distance between the insides of the steam-ports	0	5·31	0	4·56	0	4·56
Distance between the outsides of ports	0	8·85	0	7·71	0	7·71
Width of steam-ports	0	1·77	0	1·57	0	1·57
Inside cover of slides	0	0·39	0	0·39	0	0·39
Outside cover of slides	0	0·98	0	0·98	0	0·98
Diameter of slide-rods	0	1·26	0	1·26	0	1·26
Distance of rod from cylinder-face ..	0	2·06	0	2·32	0	4·01
From centre of cylinder to face ..	0	12·6	0	16·59	0	19·09
Diameter of steam-pipe	0	4·33	0	3·93	0	3·93
Do. exhaust-pipe	0	5·51	0	4·72	0	4·72
GENERAL DIMENSIONS.						
Height of buffer-spindle above rail ..	3	1·59	3	1·59	3	1·59
Between centres of buffers	5	8·38	5	7·99	5	7·99
Between centres of safety-chains ..	2	3·56	3	10·85	3	10·85
Height of centre of draw-har	3	3·37	3	1·59	3	1·59
Height of buffer of tender	3	3.37	3	6·91	3	1·59

THE NEW NORTH WESTERN LOCOMOTIVES.

The London and North Western Railway Company are offering some of their passenger locomotives for sale, to make room for tbe new express engines making hy Messrs. Fairhairn & Son, of Mancbester, and Messrs. E. B. Wilson & Co., of Leeds, and which are to do tbe distance from London to Birmingbam (113 miles) in two bours. To do tbis, it is said, they must be able to evaporate 260 cubic feet of water per hour. Their leading dimensions are as follows:—Cylinders 18 inches diameter and 2 feet stroke. Six wheels. The driving-wheels 7 feet 6 inches diameter; hoiler-harrel 4 feet diameter, containing 300 tuhes, $1\frac{1}{4}$ inch (inside) diameter and 7 feet long. The cylinders are inside; and, in order to reduce the height of the engine, tbe underside of the barrel is curved in where it meets tbe fire-hox, to make room for tbe cranks. The fire-box is of unusual size, and divided hy a vertical water space the whole depth, thus forming two furnaces, whicb meet before they reach the tuhes. This fire-box contains 260 feet of beating surface, and about 1,400 stays! Tbe tuhes, it will he ohserved, are short, but numerous. The total heating surface is 1,700 square feet. Some of tbe stays in the fire-hox are made hollow, and open at the ends, so tbat they will admit jets of atmospheric air, to assist the comhustion. The springs are of India-ruhher. The axles are hollow, and, to form tbe journals, are made bot, and creased in, so as not to diminisb tbe tbickness of metal at that part. The tender is to carry 3,000 gallons of water, and two tons of coke, so that it can run to Birmingham without stopping.

Witb reference to the speed proposed to be attained, we may say that there is no difficulty, hecause it has heen often done before; hut there is another difficulty, or rather two difficulties, viz., tbe maintenance of the permanent way, and of the dividend.

AGRICULTURAL ENGINEERING.

(Continued from p. 238.)

Boyd's Self-adjusting Scythe.—A scythe is proverbially a very awkward instrument to handle, and it appears extraordinary that no inventor has ever taken it in hand hefore. Mr. Boyd has not only rendered it adjustable, but also "packable," hy very simple and effectual means. The former property cnables the mower to adjust the scythe to his own height, and to that of the crop, and thus renders it unnecessary to have two or more scythes. Fig. 1 is a view of tbe scythe folded

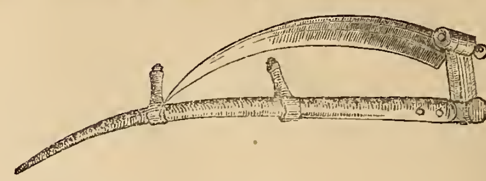
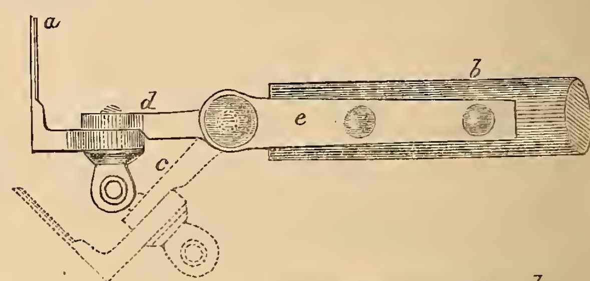


Fig. 1.

together, and figs. 2 and 3 are enlarged views of the joint, in whicb the novelty consists; *a* is the hlade, and *b* tbe handle, both being hroken off in tbe larger scale drawing. Tbe hlade, *a*, bas an eye at the end,

Fig. 2.



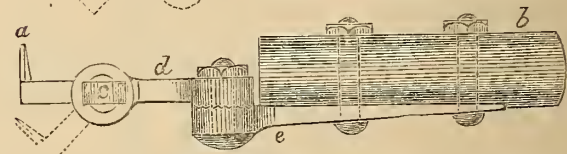
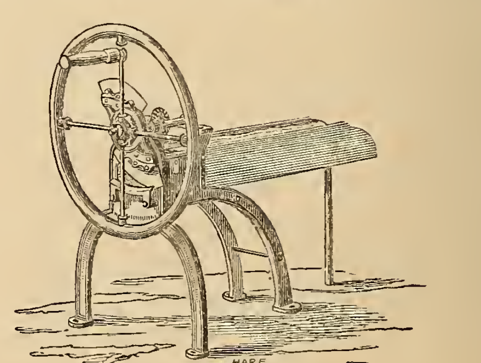


Fig. 3.

and there is a corresponding eye on the swivel piece, *d*, the set screw, *c*, going tbrougb hotb, and serving to secure them togetber. The other end of tbe swivel piece is made with a series of radial teeth on the face of the eye, and similar teetb are made on the holder, *e*, so that they can he adjusted to any angle, as shown hy the dotted lines, the interlocking of tbe teeth, when compressed by tbe holt, holding them securely together, witbout tbe possihility of tbeir slipping. Tbe ease witb which tbis instrument can be taken asunder, adjusted, and put togetber, renders it deserving of every commendation.

This scythe is manufactured by Messrs. Dray and Co., of London, and was exhibited hy tbem at tbe Lewes Sbow of tbe Royal Agricultural Society, where it attracted our attention.

Lomax's Patent Chaff-cutter.—Tbe neatest and *most mechanical-looking* chaff-cutter which we have seen is Lomax's, made by



Mr. Smith of Uxhridge. The perspective view attached shows the general plan on which it is constructed. Only two knives are employed,

but they are placed at such an angle, that they have a large amount of "draw," and in consequence cut with less power. A guard is placed in front of the knife, which supports the straw on both sides, whilst it is being cut, and it therefore cannot drag the straw, as is frequently the case. At the moment of cutting, the top of the mouth-piece is depressed, and holds the straw firmly, rising when the straw has to be advanced for a fresh cut. The feed is also stopped whilst the cut is taking place. By a simple adjustment they are made to cut three lengths of chaff.

Use of Liquid Manure distributed by Steam Power.—At page 190 we described our impressions of Mr. Mechi's farm, and the effects of the liquid-manure system. Since then he has taken up a portion of his crop, of which the following is his account :—

"To remove all doubt as to the quantity of mangel wurzel on my six-acred field, I annex the details :—One good square rod contained 89 roots; average weight, 8 lbs. 2 ozs. each, or 52 tons per acre. One bad square rod, 89 roots; average weight, 5½ lbs. each, or 35 tons per acre. Average of the whole field, taken at the most moderate computation, 43 tons per acre. Average of another ten-acre field, not so highly liquified, 87 roots per rod, 30 tons per acre. Many of the roots weigh 23 lbs. to 25 lbs. each, without tops, and measure 33 to 42 inches in circumference. There were gaps in each rod measured, but still the number of roots was great, as they almost touched one another. I attribute this large production to deep cultivation by forking, but more particularly to the use of liquified manure. Superphosphate of lime, at the rate of 2 cwt. per acre, was drilled under the roots. I have also a very heavy crop of Swedes, the best I have seen, manured with 2 cwt. of superphosphate of lime and liquified manure; soil, a strong yellow plastic clay, once very deeply ploughed before winter, and scarified in the spring. I have also had a very heavy crop of cabbages. In fact, I see clearly that the liquified manure will enable me to produce my root crops at 5*s.* per ton, and will very largely increase my other productions. We frequently make the drains run, although they are at five feet deep, with our liquid manure. The liquor is coloured, but has only an earthy smell after filtration. One load of bullock or cow dung liquified will manure more land than four loads dry; it acts immediately, and gives a quick return. I have not the least doubt, that within forty years our rivers and brooks will be used for irrigation and for drainage, our millers will use steam. We shall then be spared the painful records of perplexed discussions and threatened actions, and shall read, in lieu thereof, 'Tenders for the sewage of such and such towns, lunatic asylums, and parochial unions, for the term of twenty-one years, will be received by the committee on such and such a day.' The essence of bread and beef will thus ebb back to its original parent—mother earth; the farmer will no longer fret and stew about Lobos Islands, Peruvian monopoly, or peculative deception; ingenious compounders of 'genuine' guanos will be spared the trouble of a frequent visit to the sandy loam of Wanstead Flats. I fancy that I see 'practical' men stamping their feet, raising their spectacles, or scratching their heads at these my 'visionary' prognostics; but, like many other 'impossibilities,' they will certainly be fulfilled. It is a mere question of time and belief. We may as well, therefore, begin to talk about economising our manures."

Improved Manure Distributor.—Mr. E. Fogden, of East Dean, near Chichester, agricultural engineer, has registered an improved dry manure distributor, of which fig. 1 is a transverse section, and fig. 2 a longitudinal section. A A is a long box or hopper, in which the manure is put, after being powdered and sifted. B is a fluted roller, which occupies a position parallel to a long slot in the bottom of the box. C and D are two brushes, the bristles of which press against the roller, B. The front brush, C, is fixed to the side of the hopper; the other, D, is capable of being slid further up from or closer down upon the roller, by screws, *a a a*, according to the quantities of manure which it may be

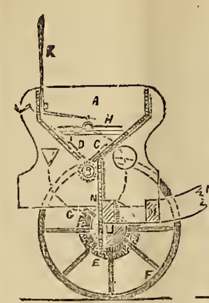


Fig. 1.

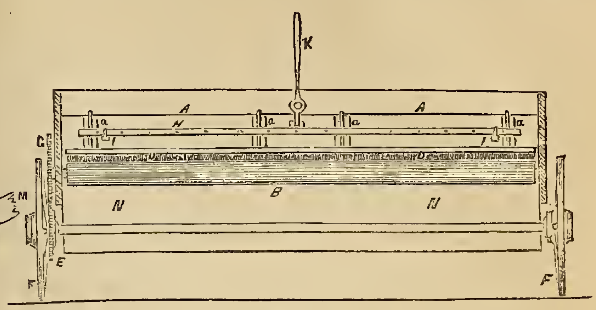


Fig. 2.

thought fit to allow to escape; E is a spur, which is fixed to the nave of one of the bearing-wheels, F F, and which gears into a wheel, G, affixed to the end of the roller, B ;—motion is thus communicated from the bearing-wheels to the roller, to cause the dispersion of the manure. H is a bar, which runs along the centre of the hopper, A, in which it is supported by cross-bars I I. This bar is furnished with a set of projecting arms, and is acted upon by a lever, K, so that the attendant may, by moving the lever, prevent the manure from getting clogged or arched in the hopper. The shafts are attached to the machine at M M : N is a guard-board, to prevent the wind from scattering the manure.

Clayton's Patent Brick-making Machine.—We have had the pleasure of seeing this new machine in operation, but too late in the month to admit of our doing more than briefly noticing it. It is constructed so as to serve, first, as a pug-mill to prepare the clay, and, secondly, as a brick-making machine. It consists of a strong cast-iron cylinder set vertically, and having a shaft in the centre furnished with a series of screws, which bring the clay down and cause it to exude from two dies, placed at the back and front of the cylinder. These dies give the required shape to the brick, and the clay, after passing along an endless band, is cut into the proper thicknesses by a series of wires, just as in Mr. Clayton's well-known pipe-making machine. The clay, after being dug from the field, watered, and turned over in the usual manner, is cleared from stones, and thrown into the machine, which renders any previous pugging unnecessary. One horse is sufficient to work it, although steam or water power may obviously be applied to it. With one man to fill, and two boys to take away the bricks, it is calculated to produce 7,000 to 10,000 bricks per day, of a superior quality to those made by hand labour, and at a lower cost, inasmuch as no skilled labour is required.

NOTES BY A PRACTICAL CHEMIST.

Process for imparting greater Brightness to Indigo Blues in Stuffs.—It is well known that the blue colouring matter of indigo is insoluble, and, in order to fix it upon the stuffs, it is necessary to deoxidise it by means of proto-sulphate of iron and lime. By dipping the stuffs into a solution of deoxidized indigo, a darker or lighter colour is obtained, according to the duration of the immersion. Indigo is also of a volatile nature, and this is one of its characteristic properties. It occurred to the author (M. Guillouet) to turn this property to account, by exposing the stuffs coloured with indigo to the action of a high temperature, under constant pressure, in air-tight metallic vessels, strong enough to resist an internal pressure sufficient to act upon the particles of indigo and to incorporate them with the fibres of the stuff, and thus produce a change in the physical constitution of the indigo. The form of the vessels employed is immaterial, but they must be fitted with a safety valve, and also with a tap, through which the atmospheric air escapes, on introduction of the steam.

The stuffs died with indigo are laid one upon another in the vessel in a wooden pan, and enclosed in a cloth, which serves to prevent their coming in contact with the sides of the vessel, and to absorb the moisture produced at the first admission of the steam. Steam is then introduced at a pressure of from 2 to 6 atmospheres. After about half an hour, the cover of the apparatus is removed, and the stuffs taken out, and left to cool, when they may be folded and packed. This operation communicates a violet tinge to the colour of the indigo, without injuring the other true colours fixed on the stuff, which, on the contrary, become fuller and brighter. The web loses considerably in length in the operation, but the loss in breadth is scarcely perceptible; at the same time a thicker and finer texture and more body and softness are produced.

Improvement in the Production of "Bleu de France" on Wool.—The method now employed for producing "bleu de France," consists in boiling the wool in a bath containing ferridcyanide of potassium, an acid, and chloride of tin, until a pure blue is produced. During this process, a large amount of cyanogen is lost as hydrocyanic acid. To obviate this loss, the process has been so modified as to precipitate the whole, or the greater part, of the cyanogen upon the fibres of the wool, in combination with iron. This object may be accomplished by adding a salt of iron to the bath, by preference the sesquichloride. The dyeing is performed as follows:—The ferridcyanide of potassium is first dissolved in the bath, then a small portion of the acid to be used, and lastly the chlorides of tin and iron. The liquid is now clear, and has a brownish colour. The wool, well washed, is put in while warm, and the bath heated to boiling. The wool at once takes a dark green colour, and, after adding the remainder of the acid, becomes, on further boiling, a beautiful blue. In this manner a given shade of colour was produced with 25 per cent. less ferridcyanide than in the usual process. Experiments undertaken to ascertain the best proportions for adding chloride of iron, proved that the maximum effect was given by employing chloride equal to half or three-fourths the weight of the ferrocyanide. A larger amount gave a fainter colour. The chloride was solution of iron in muriatic acid, through which chlorine has been passed. Less acid is here required than in the common process, and the tartaric proved most satisfactory. The ferridcyanide used must be perfectly free from ferrocyanide, otherwise the addition of sesquichloride of iron would determine a precipitate of Prussian blue.

M. Weishaupt's Lithographic Ink.—

40 parts yellow wax
10 „ mastic
28 „ gum-lac
22 „ Marseilles soap
9 „ lamp-black.

The wax is heated until its vapour can be ignited with a burning match, then withdrawn from the fire, and the soap, gum-lac and mastic added by small portions. The flame is then put out, and the lamp-black well worked in. Heat is again applied till the vapour can be kindled, when it is removed from the fire, and, after the flame is quenched, poured upon a stone and cut into small pieces.

Remarks on Electro-plating, by Dellisse.—It has been ascertained by experiment that all salts of silver do not form a continuous metallic layer upon the object to be plated. The conditions found needful are:—

1. A proper power of conduction in the liquid.
2. That no other metal should be deposited during the action of the galvanic current.
3. That the object to be silvered should not be corroded by the bath.
4. The liquid should have an alkaline reaction.

Another condition has lately been detected by Bouilhet; the bath, namely, must contain a double salt of silver and a fixed alkali. Only two classes of salts, the cyanides and hyposulphites, answer these conditions. The double compounds of ammonia and silver have been pronounced valueless for plating. The author finds that a bath of double sulphite and acid hyposulphite of ammonia of 8°, in which oxide of silver, or an insoluble salt, such as chloride of silver, has been introduced, proves best.

Report on various Methods of detecting Iodine.—MM. Chatin and de Claubry have given in the following report to the Société de Pharmacie:—The formation of blue iodide of starch, as a test for iodine, was noticed in 1814, and subsequently examined by Stromeyer and Lassaigne. The delicacy of this process has made it very useful in searching for iodine. The use of chloride of palladium for the same purpose was declared by Lassaigne preferable to starch, but, in operating on coloured fluids, the results cease to be accurate. Sulphuret of carbon and chloroform, suggested for the same object, as solvents of iodine, may be used in certain cases, but are still much inferior to starch properly applied. Casasica thought that sulphuric ether might be used in investigations of this kind; but he was led into error from the presence of acetic ether in the specimen he employed. Every one has, therefore, returned to the formation of iodide of starch, in conditions which render its employment more or less sensitive. If a paste of starch is introduced into a liquid containing even traces of soluble iodide, and chlorinated steam is passed over the mixture, the characteristic colour of iodide of starch becomes gradually diffused; but if the chlorine is in excess, all traces of iodine will disappear. Sulphuric acid is preferable for this purpose, and enables us to detect very small quantities of this body. But the sensibility of starch under the influence of nitric acid, or a mixture of nitric and sulphuric, is much greater than with sulphuric acid alone. When the proportion of iodide is below one-millionth, nitric acid still produces a very characteristic blue colouration.

Purification of Naphtha and Preparation of Naphthaline.—A correspondent, Mr. Isaac Whitesmith, of Glasgow (in reference to our remark at p. 247, to *Tyro*), suggests the following method of purifying coal-naphtha, so as to fit it for preserving potassium:—Take a considerable quantity of the best rectified coal-naphtha, and add about 10 per cent. of concentrated sulphuric acid. Keep them in contact, with frequent agitation, for three or four days. Decant the naphtha, and add fresh acid, repeating the same process several times. The naphtha, which is now of a deep red colour, with an acid reaction, and most pungent odour, is distilled very gradually, and neutralised by a current of dry ammoniacal gas passed through it. It is then repeatedly distilled, rejecting the last portions. Thus, it finally appears as an exceedingly mobile, limpid fluid, of a pleasant odour, and is perfectly adapted for preserving potassium. To obtain naphthaline, mix common bituminous coal in fine powder with an equal quantity of quick-lime, put the mixture in a small tin-plate still, and heat over the gas furnace for about an hour. On afterwards opening the still, naphthaline will be found deposited inside the head.

ANSWERS TO CORRESPONDENTS.

"J. H."—1. The principal acid found in bran, *as such*, is the phosphoric, combined with earths and alkalies. When mixed with water and allowed to stand (we do not speak here from personal observation), there is a development of acetic and lactic acids. Its action in clearing dyed goods seems to be to a great extent mechanical. "The feebly combined colouring principle," says Parnell, "dissolved by the hot water and mucilaginous matters present, instead of being retained in solution, is precipitated on the husky surface, and prevented from again attaching itself to the cloth. Coarse bran is better adapted for this purpose than fine, and flour is altogether useless."

2. "What is the best antidote after inhaling prussic acid gas to a state of vomiting?"—Cold water should be dashed upon the spine until the symptoms abate. Diffusible stimulants, such as brandy, ether, and dilute ammonia may be given internally.

3. "Bancroft's Philosophy of Permanent Colours."—We are not aware of any work of the kind in the English language. If our correspondent reads German we would recommend *Runge's "Farbenchemie,"* a translation of which is, we believe, in course of preparation.

DEATH OF MR. BARNES.

At La Ciotat, in France, on the 24th of September last, died Mr. John Barnes, the eminent engineer, in the fifty-fourth year of his age.

Rich as this country is in eminent engineers, we believe we can with confidence assert that it has never produced one of greater ability than Mr. Barnes, excepting only his great master James Watt, whose steps he followed, and whose exalted position he more nearly than any other living man approached. Lately the engineering world sustained a severe loss in the death of Mr. Farey, and now it has to mourn the loss of Mr. Barnes, who, whether as an engineer of profound attainments, or as a man of large heart and genial disposition, leaves, perhaps, but few equals behind him. The death of such a man, still in the vigorous exercise of his faculties, is a loss to the human kind. To his friends it is an afflicting bereavement, which lessens their ties to this lower world. Never more shall we be instructed by his wisdom, melted by his benevolence, or exalted by the intercourse of his master mind; and the recollection of the moments spent in his society is like the sunny memories of some superior state of being, in which we were for a time lifted above the ignorance and sordidness of the world. Whatever other engineers knew Mr. Barnes also knew, and in mere engineering attainments he was probably superior to every contemporary. The narrow domain of engineering science, however, was not sufficient to satisfy his aspirations, but his vision extended over almost every department of human knowledge. The main secret, indeed, of his eminence, as an engineer, was that he was not an engineer merely: his intellect was too colossal to be cooped up in that narrow field which smaller minds think it the achievement of a life to explore; and his mind was, consequently, enabled to retain its just proportions, and to grow up without deformity to that loftiness of stature which only greatness attains. We have on many occasions endeavoured to impress upon young engineers the necessity of cultivating all their capacities, if they would desire to rise above the crowd—to be something more than the mere hewers of wood and drawers of water of engineering science—and to have an intelligence superior to that of the deaf and dumb tools with which they work. By many this language will never be understood. It is the tendency of all young minds, and especially of minds of no great force or elevation, to value technicality too much; to conclude that an acquaintance with certain modes and processes is the summit of human proficiency, and thereby to mistake the means for the end. Technical knowledge is, of course, necessary to the engineer, but it is not all sufficing; and a man may be cognisant of all known facts in that department of knowledge, and yet be nothing better than a mere walking portfolio. Facts are the materials merely with which the imagination has to work, not the finished fabric; and if the imagination be frozen, either by the precepts of authority, or by the want of miscellaneous exertion, there never can be any approach to that engineering excellence which it should be the ambition of every engineering student to attain. All experience shows us, that it is not by those persons who content themselves with recipes of excellence that excellence is really reached. To arrive at that goal, there must be an exercise, not merely of memory, but of mind. The imagination and judgment must both be called into play. But how is this possible, if the imagination is quenched and the judgment unexercised? The want of mere technical knowledge is a trivial deficiency, because it is one easily supplied. But how shall we supply the want of soul? Those, therefore, who would desire to become skilful engineers, we would counsel to follow Mr. Barnes' example, in extending their survey to other departments of knowledge, for it is thus that the distorting influence of technical acquisition upon their minds may be most readily corrected. Technical knowledge is the mere alphabet of their art, and is, of course, necessary to their progress; but it will totally fail them, and pervert their other faculties, if they make it the end of knowledge instead of the key.

Such, then, are a few of the reflections which naturally occur to us in contemplating the character of Mr. Barnes. The main incidents of his career may be more briefly recounted. Up to the age of fifteen he spent his time, like most boys, at a classical and mathematical school. At seventeen he went to Soho, where, under the instruction of James Watt, he had unusual facilities for the acquisition of engineering knowledge; and, what was more important, he had the benefit of the conversation and example of his great master in moulding his character at that ductile age. At nineteen he was sent to the University of Edinburgh, and at the age of twenty-two he was placed as a pupil with the late Mr. Giles, an eminent engineer of that day. After this time, and up to the year 1835, Mr. Barnes was in partnership with Mr. Miller, and with them originated the engineering firm of Barnes and Miller, now Miller and Ravenhill, so well known in the engineering world. Finally, Mr. Barnes settled in France, where he resided at the time of his decease. His malady lasted for five weeks, but it was only about a week before his death that a fatal termination was apprehended. The ladies Mr. Barnes and Mr. Miller married were sisters. Mrs. Miller died some years ago; Mrs. Barnes survives, but we are not aware that there are any surviving children.

After the termination of his connection with Mr. Miller, Mr. Barnes continued to supply engines for steam vessels and for other purposes. He constructed for the French government the machinery of the screw steam frigate *Napoléon*, one of the first vessels in which the screw propeller was successfully introduced. The machinery of the French vessels *Courier, Calvados, Hercules, Phœnix, Alcides, Rotterdam, Amsterdam, Morlaisien, Etoile*, and a great number of other vessels, was constructed by him. His works at La Ciotat were very numerous and important, his last performance being the engines of the *Charlemagne*.

The world rolls on in its inexorable course, and we, the insects on its surface, drop one by one away! Nothing survives except the memory of worth and of achievement—of things done and of things loved. All else is vanity, and as such will melt like the airy frostwork of a vision, leaving no trace of where it stood. Even such names as that of Mr. Barnes will become fainter in the course of years. What, then, will be the fate of those who are without aspiration and without love?

BRISTOL AND ITS DOCKS.

An inspection of the existing docks and railway accommodation at the city of Bristol can hardly fail to induce the reflection that a large sum of money has been expended with a very inadequate result. In 1850, after an inspection of the docks, with an important commercial object in view, we recorded the result at p. 250, vol. 1850, the pith of which, from its appropriateness, we may here quote:—

"The (London) Blackwall Railway has never answered the purpose for which it was originally intended, because, to bring a few casks of sugar three or four miles, it is not worth while practically to put them into a railway truck, and then again into a cart at the Minories, to get them to their destination. At Southampton the principle is partly carried out with evident good effects. A branch line runs through the warehouses and along the river, so that each of the numerous manufacturing establishments on its banks have the railway at the gate of their premises. *Bristol is very deficient in railway accommodation of this kind, although, from the large area of ground over which the docks and river frontage extend, it seems peculiarly to want it, to foster the rising trade of the port.*"

Since this was written, the opening of the North Western and Dock Junction Railway has had a material effect on the Blackwall Railway, and we may mention, as an example, that we saw a short time since,

in the new portion of the East and West India Docks, the screw of the *Mauritius,* which had been sent in a truck direct from Messrs. J. Watt and Co.'s works at Soho, to the ship.

A very extensive project is on foot, which, if carried out according to the published prospectus of the promoters, cannot fail to have a very important influence on the trade of Bristol, as well as of that portion of the West of England generally of which it is the commercial centre. A company has been incorporated, under the title of the Kingroad Harbour Docks and Railway (Port of Bristol) Company, whose object it is to make another "Great Grimsby" at Kingroad. The works are to consist of extensive docks, dry docks, quays, ship-building and repairing yards, and (we presume) engineering establishments. The whole to form a packet station for ocean steam-ships of the first magnitude, and to be connected with the Great Western Railway by branch lines, which will also accommodate the existing docks and bonded warehouses in the city. A report has been made to the promoters of the company by Mr. Rendel, C.E., assisted by Mr. Blackwell, in which the cost is estimated at one million and a half. This estimate includes the purchase of fifty acres of land on the Somersetshire side, and 450 acres on the Gloucestershire, which, with 125 acres of unreclaimed land on the former shore, and 160 acres on the latter, will make a total of 785 acres.

The proximity of the Welsh coal field is urged as an important advantage to the large steam-packet companies, in the event of their choosing Kingroad Harbour as their port of departure. We understand that the necessary parliamentary notices have been given, and it is very likely that we shall soon be in possession of the other details connected with the project.

THE BUILDING AND FREEHOLD LAND SOCIETIES' QUESTION.

(Concluded from page 246.)

The great error which has been usually committed in the formation of building societies, has been the establishing them on the "terminating system;" that is to say, it is estimated that all the members will be paid out in a certain time, say from ten to fifteen years, and the society wound up. This system, which appears plausible enough on the face of it, has this serious defect:—A member, A, borrowing, say £150 at the commencement of the fifteen years, would only have to pay £10 a year (with interest, &c.) to clear off his liability, whereas B, who joins the society when it has only ten years to run, has to pay £15 a year, and C, who joins when it has only five years to run, has to pay £30 a year; thus, the primary object of these societies being to give facilities for the payment of small sums, new members do not join after the first few years, and as the borrowers do not come forward in regular gradation, the funds lie idle for a portion of the time, and a loss of interest takes place, the interest allowed by a banker being very much less than that payable by borrowers, and it is on this last that the profits of the societies are calculated.

The permanent plan devised by Mr. Scratchley has the following advantages:—

1st. The difficulty of finding borrowers at any time in the course of the existence of a society is removed.

2ndly. New members may enter in any month without having to pay up any arrears, or an increased entrance fee. Hence, the scope of the society's action is extended, and the power resulting from mutual association of doing good is greatly augmented, as the number of shareholders increases year by year, and even month by month, instead of diminishing.

3rdly. The initial and annual expenses can be more equitably divided, and spread over a larger number of members.

4thly. A member may, under reasonable restrictions, withdraw his subscriptions, or effect the redemption of a mortgage, without the delay or expense that he would experience in a terminating society.

5thly. The duration of members' subscriptions can be fixed with greater certainty. A difficulty which may arise from the decease of a borrower should also be taken into account:—his widow or family may be unable to continue the payments, and the society will thus be compelled to foreclose the mortgage, and sell the house, in order to secure itself from loss. In such case, a sacrifice must inevitably be made, and the expectations of the invester entirely frustrated.

This difficulty may be met by a "terminable life insurance;" that is to say, the borrower shall pay a sum of money, in addition to the ordinary periodical payment, which, in the event of his death, shall satisfy any further claim which the society might have had upon his property. This life insurance need not necessarily terminate with the expiration of the mortgage on his house; if he can afford to pay an increased rate, it may be kept up until his death, when his family will reap the benefit of his investment. Again, this insurance may be turned to another account; it may constitute a guarantee fund, so as to serve as security for the invester, in the event of his taking a place of trust, and the difficulty of finding solvent sureties thus obviated. A natural objection to guarantee associations, simply as such, is that the honest subscriber feels that he is paying his share for other people's dishonesty, and that, when he dies, all the money which he has paid is lost to him and his family.

BUILDING COMPANIES AND SUBURBAN VILLAGE ASSOCIATIONS.

The principle of the freehold land society may be still further carried out, and with great advantage, both in a sanitary and commercial point of view, in the following manner:—

A fund is to be raised by shares, payable in a short time by a few instalments, which is to be expended in purchasing a tract of land, and building on it houses of a suitable character, combining all the advantages which modern science and skill can afford. These houses are then to be let to tenants, who may, or may not, be shareholders in the building company, and who will pay such a rent as will cover the cost of the house in a certain number of years. This system has numerous advantages. A company starting with cash in hand can deal more advantageously than most builders; the tenant can be consulted in the fitting and decorating of his house; and the time of payment can be made to suit his convenience.

It is obvious that, if it is to the convenience of a purchaser of land in this country to pay for it by instalments, the case applies equally to the emigrant, who may have sufficient capital to convey himself and his family to the colony, and a small surplus against contingencies. A company properly organised should receive this family on landing; put them in possession of a log hut, and a farm ready cleared, and give them two years to settle down in, before asking any payment. The advantage of a "fair start" is nowhere felt more than in an emigrant's venture, and this would be secured to him in the best possible shape. The same system of life insurance which is proposed to be applied to the members of the building society is here available to meet the contingency of the death of the emigrant, which, whenever it might occur, would leave his family in undisturbed possession of their inheritance.

It is suggested that the employment of capital in this manner would be an excellent field for our numerous benefit societies, who might thus not only receive a higher rate of interest than they are now doing for their funds, but, at the same time, effect a great public good, by placing colonisation on a sound basis. Our space will not allow us to do more than glance at the various subjects; but the inquirer will find in Mr. Scratchley's work much interesting and valuable information on this truly national subject.

DIMENSIONS OF NEW STEAMERS.

"AUSTRALIAN" AND "SYDNEY."

Built by Messrs. William Denny and Brothers. Engines by Messrs. Tulloch and Denny, of 300 (nominal) horse power.

Dimensions.	ft.	tenths.
Length on deck	236	0
Breadth of beam	34	1
Depth of hold, do.	24	0
Length of engine-space	76	2
Tonnage.	tons.	
Engine-room	667	
Register, N.M.	734	

Fitted with a pair of geared beam-engines and tubular boilers; diameter of cylinders, 5 feet 6 inches; length of stroke, 4 feet 6 inches; diameter of screw, 14 feet; pitch of do., 18 feet; number of blades of do., 2; number of boilers, 2; length of do., 15 feet 6 inches; breadth of do., 9 feet 6 inches; height of do., exclusive of steam-chests, 14 feet; cubic feet in steam-chests, 1,486; number of furnaces, 12; breadth of 8 side furnaces, 2 feet 3 inches; breadth of 4 centre do., 3 feet; length of fire-bars, 6 feet 9 inches; number of tubes, 832; internal diameter of do., 3¼ inch; length of do., 6 feet 6 inches; diameter of chimney, 5 feet 11 inches; height of do., 40 feet; load on safety-valve, in lbs., per square inch, 11 lbs.; gross indicated power, 576; contents of bunkers, in tons, 400; consumption of coals per hour, 18 cwt.; draft forward, 15 feet 6 inches; do. aft, 16 feet 6 inches; average revolutions, 60; speed, in knots (still water), 11; weight of engines, 150 tons; do. boilers with water, 150 tons; frames, 5 inches × 3 inches × ⅝ inch, and 15 inches apart, centre to centre; number of strakes of plates from keel to gunwale, 15; thickness of plates, ⅞ to ½ inch; number of bulkheads, 8; 3 masts; barque-rigged.

Intended service, Australian mail. Classed at Lloyd's A 1.

The *Australian* and *Sydney* are alike in all respects.

"ANDES" AND "ALPS."

Built by Messrs. Denny and Brothers, Dumbarton. Engines by Messrs. Tulloch and Denny, of 300 (nominal) horse-power.

Dimensions.	ft.	tenths.
Length on deck	236	6
Breadth of beam	34	1
Depth of hold, do.	24	0
Length of engine-space	76	0
Tonnage.	tons.	
Hull	1,140	
Engine-room	667	
Register, N.M.	772	
Do., O.M.	1,300	

Fitted with a pair of geared beam-engines and tubular boilers; diameter of cylinders, 5 feet 6 inches; length of stroke, 4 feet 6 inches; diameter of screw, 14 feet; pitch of do., 18 feet; number of blades of screw, 2; number of boilers, 2; length of do., 15 feet 6 inches; breadth of do., 9 feet 6 inches; height of do., exclusive of steam-chests, 14 feet; cubic feet in steam-chests, 1,486; number of furnaces, 12; breadth of 8 side furnaces, 2 feet 3 inches; breadth of 4 centre do., 3 feet; length of fire-bars, 6 feet 9 inches; number of tubes, 832; internal diameter of do., 3¼ inches; length of do., 6 feet 6 inches; diameter of chimney, 5 feet 11 inches; height of do., 40 feet; load on safety-valve, in lbs., per square inch, 11 lbs.; gross indicated power, 576; contents of bunkers, in tons, 400; consumption of coals per hour, 18 cwt.; draft forward, 15 feet 6 inches; do. aft, 16 feet 6 inches; average revolutions, 60; speed, in knots (still water), 11; weight of engines, 150 tons; do. boilers with water, 150 tons; frames, 5 inches × 3 inches × ⅝ inch, and 15 inches centre to centre; number of strakes of plates from keel to gunwale, 15; thickness of plates, ⅞ to ½ inch; number of bulkeads, 8; 3 masts; barque-rigged.

Intended service, Liverpool, New York, and Chagres. Classed at Lloyd's A 1.

The *Andes* and *Alps* are alike in all respects.

"CLEOPATRA."

Built by Messrs. Alexander Denny and Brother. Engines by Messrs. Tulloch and Denny, of 250 (nominal) horse-power.

Dimensions.	ft.	tenths.
Length on deck	228	0
Breadth of beam	32	0
Depth of hold, do.	25	2
Length of engine-space	63	0
Tonnage.	tons.	
Engine-room	$558\frac{54}{100}$	
Register, N.M.	$893\frac{48}{100}$	
Do., O M.	1,138	

Fitted with a pair of geared beam-engines and tubular boilers; diameter of cylinders, 62 inches; length of stroke, 4 feet 6 inches; diameter of screw, 14 feet; pitch of do., 18 feet; number of blades of do., 2; number of boilers, 2; length of do., 9 feet; breadth of do., 12 feet 9 inches; height of do., exclusive of steam-chests, 14 feet 4 inches; cubic feet in steam-chests, ; number of furnaces, 8; breadth of do., 2 feet 8 inches; length of fire-bars, 6 feet 6 inches; number of tubes, 580; internal diameter of do., 3¼ inches; length of do., 6 feet; diameter of chimney, 5 feet 11 inches; height of do., 40 feet; load on safety-valve, in lbs., per square inch, 10 lbs.; gross indicated power, ; area of immersed section, ; contents of bunkers, in tons, ; consumption of coals per hour, cwt.; date of trial, ; draft forward, ; do. aft, ; average revolutions, ; speed, in knots (still water), 10; weight of engines, 150 tons; do. boilers with water, 130 tons; frames, 5 inches × 3 inches × $\frac{9}{16}$ inch, and 18 inches apart; number of strakes of plates from keel to gunwale, 21; thickness of plates, ¾, $\frac{11}{16}$, ⅝, $\frac{9}{16}$ and ½ inch; number of bulkheads, 6; 3 masts; full-rigged ship. Classed at Lloyd's A1.

H.M.S. AGAMEMNON.

The accompanying particulars (from the *Nautical Standard*) may be useful to many of our readers.

The screw line-of-battle ship *Agamemnon*, 90, Captain Sir Thomas Maitland, is reported to be under the shipwright's hands. When under full sail she will spread 10,859 yards of canvas; her entire sail comprising 24,681 yards, and not 37,200 yards, as we erroneously stated in our last publication. The following are the dimensions of her spars, rigging, &c.:—

Mainmast.

	ft.	ins.
Length of housing from the heel to the deck	23	6
Length from deck to lower side of trussel-trees	67	0
Length of head	20	0
Greatest diameter	3	4

Maintopmast.

	ft.	ins.
Whole length, head included ...	73	6
Length of head	10	0
Diameter	1	10

Maintop-gallantmast.

	ft.	ins.
Length from the low side of fid-hole to hound	33	0
Length of pole	22	0
Diameter	1	1

Mainyard.

	ft.	ins.
Whole length, yardarm included	111	0
Length of yardarms, each	4	7
Diameter...	2	2½
Weight, 7 tons 3 cwt. 1 qr.		

Maintop-gallantyard.

	ft.	ins.
Whole length, yardarm included	49	0
Length of yardarms, each	2	0
Diameter	0	11½

Maintop-sailyard.

	ft.	ins.
Whole length. yardarms included	78	0
Length of yardarms, each	6	6
Diameter	1	4½

Mainroyalyard.

	ft.	ins.
Whole length, yardarm included	34	0
Length of yardarms, each	1	5
Diameter	0	7

Foremast.

	ft.	ins.
Length from deck to lower side of trussel-trees	61	11
Length of head	19	0
Diameter	3	1

Foreyard.

	ft.	ins.
Whole length, yardarms included	96	0
Length of yardarms, each	4	0
Diameter	1	11

Foretopmast.

	ft.	ins.
Whole length, head included ...	65	0
Length of head	8	9
Diameter	1	10

Foretop-sailyard.

	ft.	ins.
Whole length, yardarm included	68	0
Length of yardarms, each	5	8
Diameter	1	3

Foretop-gallantmast.

	ft.	ins.
Length from lower side of fid-hole to hounds	29	6
Length of pole	19	6
Diameter	1	0

Foretop-gallantyard.

	ft.	ins.
Whole length, yardarm included	43	6
Length of yardarms, each	1	10
Diameter	0	10

Foreroyalyard.

	ft.	ins.
Whole length, yardarm included	30	0
Length of yardarms, each	1	3
Diameter	0	6

Mizenmast.

	ft.	ins.
Length from deck to lower side of trussel-trees	51	6
Length of head	13	0
Diameter	2	2

Mizentop-sailyard.

	ft.	ins.
Whole length, yardarm included...	54	0
Length of yardarms, each	4	6
Diameter	1	0

Mizentopmast.

	ft.	ins.
Whole length, head included ...	52	6
Length of head	7	1
Diameter	1	5

Mizentop-gallantyard.

	ft.	ins.
Whole length, yardarm included...	36	0
Length of yardarms, each	1	6
Diameter	0	8½

Mizentop-gallantmast.

	ft.	ins.
Length from lower side of fid-hole to hounds	24	0
Length of pole	16	6
Diameter	0	9½

Mizen-royalyard.

	ft.	ins.
Whole length, yardarm included	36	0
Length of yardarms, each	1	6
Diameter...	0	8½

Gaff.

	ft.	ins.
Length	47	0
Diameter	0	11

Bowsprit.

	ft.	ins.
Length, exclusive of housing ...	52	6
Length of housing	25	8
Diameter	3	4

Spanker Boom.

	ft.	ins.
Length	66	6
Diameter	15	6

Jibboom.

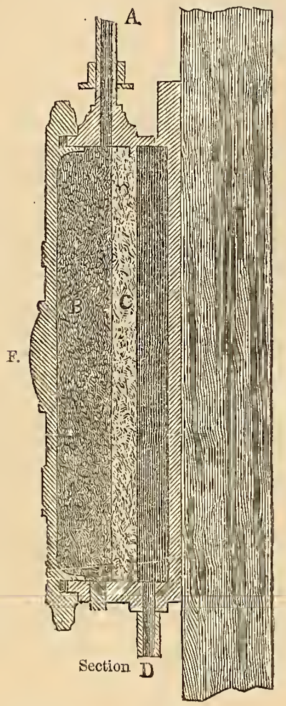
	ft.	ins.
Whole length, housing included...	53	0
Diameter	66	6

Rigging.

The bowsprit to have two chain gammons, each equal to 8½-inch rope.
The lower rigging to have nine pairs of shrouds of 12-inch rope.
The main rigging to be of wire of 5½ inches, which is equivalent to 12-inch rope.
The mizen rigging to bave six pairs of shrouds of 8-inch rope.
The fore-stays double of 14-inch rope.
The main-stay to be of 6½-inch wire, equivalent to 13½-inch rope.
The mizen-stay to be of 4½-inch wire, equivalent to 10-inch rope.
The rigging is to be turned in with a thimble, then hooked to rigmaiden's plate, and set up with a lever.

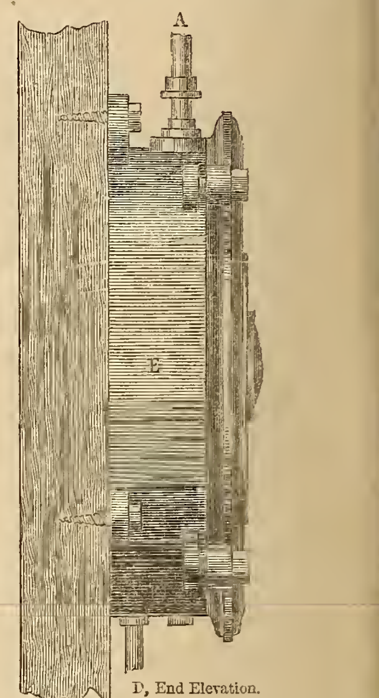
SILICIOUS STONE FILTER.

Messrs. Ransomes and Parson's Patent Silicious (or artificial) Stone, has been some time before the public, and has been gradually making way, under various forms. One of the most recent is its use as a filtering medium, to which it seems well adapted. A very neat form of filter is shown in the accompanying engravings. It is intended to be fixed against a wall, in any convenient position, and consists of a cast-iron box, having an inlet pipe, A, attached to the supply pipe; B is a chamber containing a chemical disinfectant (say peat charcoal); C is a diaphragm of the patent stone, through which the water percolates, and passes into the space at the back of the filter, and is drawn off at D; E is a cast-iron cover, secured with screws, which can be taken off when it is desired to renew the disinfecting medium.



Section D

FRONT ELEVATION.



D, End Elevation.

Another cheaper form consists of a hollow globe of the stone, to which is attached a gutta-percha syphon pipe. The globe is hung in the cistern, and the pipe hung over the side, so that the end is below the water level.

REVIEWS.

On the Propulsion of Vessels by the Screw. By R. Bodmer, C.E. London: John Weale.

We have read this brief treatise through, but we are unable to discover any practical utility to be derived from its contents. Doctrines are assumed to be incontestible which are, to say the least, very doubtful, and on these are raised a superstructure of algebra, the doctrines deduced from which no praetical man could follow with the least confidence. What we want, in connection with the screw propeller, is not a labyrinth of algebra, but a collection of reliable facts. Such contributions, even although they may be of small amount, are of real and enduring value.

A Practical Treatise on Chimneys; with a few Remarks on Stoves, the Consumption of Smoke and Coal, Ventilation, &c. By G. F. Eckstein. London: John Weale.

Mr. Eckstein is a veteran smoke doctor, and he has here given us the benefit of his extended experience, as exemplified, Abernethy-like, in a number of "cases." There is a *naïveté* about the author's descriptions of his difficulties with obstinate "scientific men," and still more obstinate cooks, which gives the reader a very clear idea that the mechanical difficulties which he had to contend with were nothing to the moral ones. The architects come very badly off, since, as we are informed, they build all the chimney flues much too small. Judging from the cases mentioned, it would appear that this is the most frequent cause of smoky chimneys. The remedy appears to be, to enlarge the flue, in order to give it more power, or to make a communication with some other flue which is perhaps seldom used, and thus obtain the power of both. Mr. Eckstein lays great stress upon the cooling effect of the wind upon exposed chimneys, which are often made only half-brick thick. In such a case, the chimney must be protected with an additional thickness of brickwork, to keep in the heat. We are glad to find that we have followed, at a humble distauce, the footsteps of such an eminent professor, in the setting of grates. Mr. Eckstein says, "I never found a chimney to smoke from the grate being *set forward*, though it is generally the first thing noticed and complained of." We have had more than one severe encounter of argument with a bricklayer, to induce him to put a grate forward in the room, so that some of the heat at least might be saved; and we hope that Mr. Eckstein's work will have greater weight with the fraternity thau our lectures had. The contraetion of the lower part of the flue appears to be a very successful means of treating smoky chimneys; and we may mention here another expedient, adopted in some parts of the west of England, where the houses are in exposed situations, and which is said to be a radical cure. It consists in inserting a piece of iron, slate, or any other convenient material a short distance below the chimney-top, in such a way as to stop up about one-third of the area of the flue on one side. It is essential that this position should be relative to the direction of the prevailing wind; but what that position should be our informant could not say. At any rate, it is easily tried, and the plate adjusted accordingly. From the practical and useful tone of Mr. Eckstein's work, we hope to see him again in print. *A good treatise on cooking-stoves is much wanted.*

An Outline of Shipbuilding. By John Fincham, Master Shipwright of H.M. Dockyard, Portsmouth. 3rd edition. With folio plates. London: Whitaker and Co.

We have already reviewed Mr. Fincham's *History of Naval Architecture,*

which forms an appropriate accompaniment to the volume before us. The words "3rd edition," render it unnecessary to say much in its favour, and we need only indicate its leading contents.

The work is divided into four parts. The first contains an elucidation of the principles which govern the form of vessels, their displacement and stability; the position of the centre of gravity; Bossut's and Beaufoy's experiments on the resistances of floating bodies; comparisons of the forms of sailing and steam vessels; the effects of the winds on the sails, &c. The second part contains a detailed account of all the parts of which the hull of a vessel is composed, and the methods of combining them; the use of iron in conjunction with timber; and, in short, all the information required by the practical shipwright. These explanations are illustrated by copious details on a larger scale, in the folio plates which accompany the work. Part the third will be read with great interest by the engineer as well as the shipbuilder, since it contains an immense amount of valuable information on the structure of various kinds of timber—their virtues and defects, the means of preserving them from decay, and the results of experiments on their comparative strengths. The manufacture of iron and copper, the methods of working them and testing their qualities, is also treated of in a very practical manner. Indeed, we think the author would be doing a service to the profession, if he would reprint this part, and publish it in a separate form, which we are convinced would be purchased by many persons who would never imagine that an *Outline of Shipbuilding* could interest them. Part the fourth consists of a vocabulary of words and phrases used in shipbuilding, with their equivalents in Swedish, Danish, Dutch, German, French, Italian, Spanish, Portuguese, and Russian.

The work is dedicated to his Grace the Duke of Northumberland.

Performance of the U.S. Mail Steamer *Arctic*, on her Eighth Voyage from New York to Liverpool. By B. F. Isherwood Chief Eng. U.S. Navy.

Day	Date. 1852.	Average steam pressure in boiler. Pounds per sq. in.	Average revolutions per minute.	Total revolutions made per day.	Time. h. m.	Anthracite coal. Tons burned per day.	Geographical miles ran per day.
1st	Feb. 8th.	17·0	14·5	20,550	23 45	85	300
2d	„ 9th.	16·7	14·3	20,167	23 30	75	310
3d	„ 10th.	17·5	15·3	21,704	23 34	80	325
4th	„ 11th.	17·5	15·8	22,419	23 30	88	331
5th	„ 12th.	17·0	15·7	22,254	23 25	89	336
6th	„ 13th.	16·1	15·3	21,497	23 31	89	234
7th	„ 14th.	17·0	16·4	23,104	23 25	92	316
8th	„ 15th.	17·0	16·7	23,440	23 23	90	307
9th	„ 16th.	16·7	16·5	23,237	23 22	91	301
10th	„ 17th.	16·5	17·5	22,594	21 25	87	295
	Totals,			220,966	d. h. m. 9 16 41	866	3055
	Means,	16·9	15·827			8337·3 lbs· pr. hr.	13·13 per hour

The *Indicator Diagram* shows 15lbs. maximum in cylinder, cut off at $\frac{4}{10}$; vacuum, 10·5 lbs. When taken, steam pressure in boiler above atmosphere per square inch, 17 pounds; double strokes of piston per minute, 16; mean effective pressure on piston throughout the stroke, 16·9 pounds; throttle partly closed; calculating the horse power developed by the engine for this pressure, and for 15·827 double strokes of piston per minute, we have, area of both pistons, 14,176·46 square inches; stroke of piston, 10 feet; mean effective pressure per square inch of pistons, 16·9 pounds; speed of piston per minute, 316·54 feet.

$$\frac{14{,}176{\cdot}46 \times 16{\cdot}9 \times 316{\cdot}54 \text{ feet.}}{33{,}000} = 2{,}298{\cdot}1 \text{ horse power.}$$

Evaporation by the Boilers.—The mean initial steam pressure in the boilers may be taken at 14·3 pounds per square inch above atmosphere, cut off at $4\frac{1}{2}$ feet from commencement of stroke of piston. Space displacement of both pistons filled per stroke with steam, 443·016 cubic feet, to which add space comprised between cut-off valve and piston at one end of cylinder (for both cylinders), 25 cubic feet, making a total bulk of 468·016 cubic feet of steam of the total pressure of 29 pounds per square inch, used per stroke of piston, which per hour would become (468·016 × 15·827 × 2 × 60) 888,874·708.

The loss by *blowing off* at $\frac{3}{32}$, will be as follows. Neglecting small corrections, total heat of steam, 1,202° Fah.; temperature of feed water, 100° Fah.; temperature of steam 29 pounds, total pressure, 249·6°; then, 1,202°—100° = 1,102°; and 249·6°—100 = 149·6°. Sum of the caloric utilised in steam and lost in *blowing off* (1,102° × 149·6°), 1,251·6°, of which 1,102° is 88 per cent. and $\frac{888{,}874{\cdot}708 \times 100}{88} = 1{,}010{,}084{\cdot}9$ total cubic feet of steam of 29 pounds total pressure generated per hour. The relative volumes of this steam and the water from which it is generated, is 911·0 and 1 and $\frac{1{,}010{,}084{\cdot}9}{911} = 1108{\cdot}765$ cubic feet of sea-water evaporated per hour, which at 64·3 pounds per cubic foot, which amount to 71,293·59 pounds of water evaporated per hour by 8,337·3 pounds of anthracite, or 8·55 pounds of water per pound of coal.

This is perhaps a higher result than has ever before been attained by a marine boiler making a long trip, and fired and cleaned in the ordinary manner by ordinary firemen. It will be observed that the results obtained, under the above practical conditions, are very different from what would be given by a more experimental trial of a few hours on shore, with a small quantity of fuel skilfully burned, and all avenues of losses carefully guarded. It must also be considered that these boilers have been in use for some time, and are probably considerably incrusted with scale.

The features of these boilers are, 1st. The heating surface is nearly all vertical surface, consisting of water tubes.

2nd. The proportion of calorimeter or draft area to the grate surface is very large at first, and diminishes to nearly one-half in the chimney, being at front of tubes 1·000 to 5·205; at back of tubes, 1·000 to 7·840; in chimney, 1·000 to 10·000.

3rd. The proportion of heating to grate surface is very large, being $33\frac{1}{4}$ to 1.

4th. The hot gases are kept by means of a hanging-bridge in contact with the heating surface, until their temperature is properly reduced.

5th. A very great height of chimney, being 75 feet above grates, giving a good draft even with the greatly diminished chimney calorimeters; the rapidity of the combustion is not remarkable as either fast or slow, being as the rate of 13·13 pounds of coal per square foot of grate per hour.

6th. A double tier of furnaces, one furnace in the upper and one in the lower tier, mingle their hot gases at the same bridge. By alternate firing below and above, the temperature of the mingled gases is always kept sufficiently high for combustion, while, practically, no inconvenience is found in firing furnaces so arranged.

Slip of the Paddle-Wheel.—The circumference of the centre of effort of the paddles is 107·3 feet. The mean slip was, therefore,

107·3 × 15·827 × 60 = 101,894·226 ft. = sp. of cen. effort of paddles per hour.
13·13 × 6140 = 80,618·200 ft. = speed of vessel per hour.

21,276·026 ft. = slip per hour, or 20·88 per cent.

The following details of the *Arctic*, from Mr. Bartol's works, may be found useful, in conjunction with the preceding :—

Merchant steamer, running between New York and Liverpool; engines designed and constructed by Stillman, Allen, and Co., New York; boilers by John Faron, Esq., chief engineer of the line (since deceased).

	ft.	in
Length on deck	286	0
Breadth of beam	45	8
Depth of hold	32	0
Tonnage	tons, 2,772	

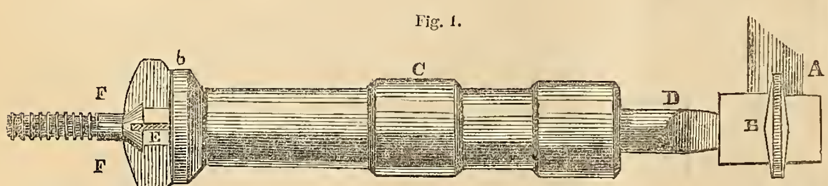
	ft.	in.
Average draft of water	19	0
Two side-lever engines		
Diameter of cylinders	7	11
Length of stroke	10	0
Diameter of paddle-wheels	35	6
Length of paddles	12	2
Depth of do.	2	2
Number of paddles in each wheel	36	
Average dip of wheel	7	5
Average number of revolutions	$13\frac{3}{4}$	
Average pressure of steam	14 lbs.	
Cutting off at	4	6
Four iron boilers (back to back) ; tubes, 2 inches diameter outside.		
Whole amount of fire surface	21,160 sq. ft.	
„ „ tube „	15,066 „	
„ „ grate „	635 „	
Ratio of fire surface to cubic foot of cylinder	$21\frac{1}{2}$ to 1	
„ „ grate surface	$33\frac{1}{4}$ to 1	
Area of space between tubes in front	122 sq. ft.	
„ „ at back	81 „	
„ chimney	$63\frac{1}{2}$ „	
Height of chimney above grate	75 feet	
Consumption of bituminous coal per hour ...	6,615 lbs.	
Water evaporated by 1 lb. of coal	$7\frac{1}{2}$ „	
Coal per hour to a square foot of grate	$10\frac{3}{10}$ „	

NOTES FROM OUR AMERICAN CONTEMPORARIES.

Switzer's Screw Driver.—The following account is taken from the *Scientific American* :—The screw driver appears to us too expensive for ordinary use ; but it appears to us that some simple modification might be scheme which would be useful for fixing metal screws, which, from the power required to turn, are sometimes disfigured from the screw driver slipping.

Fig. 1 is an outside view, and fig. 2 is a longitudinal section. This screw-driver is operated like the stock-brace, only it has spring-jaws for holding the head of the screw-nail, while the driver is inserted into the groove or notch in the head of the nail. The handle of the stock is broken off.

Fig. 1.



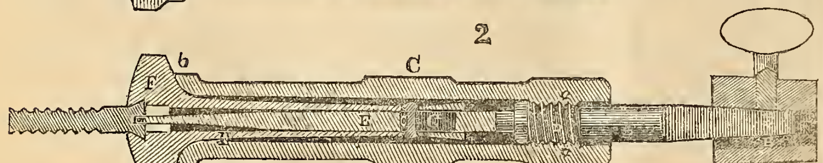


Fig. 2.

A is part of the handle, and B is the stock ; they are made in the usual manner ; D is the shank of the driver, E. F F are spring-jaws for embracing the head of the screw-nail. C is a barrel or tube surrounding the shank of the driver, and legs of the spring-jaws, F F. The spring-jaws are fastened to the shank of the driver by a pin, *c*, which passes though a slot, G, in said shank. This slot allows the driver to be thrust further out beyond the face of the jaws, or to be drawn within them. This operation is performed by having a right-handed thread cut on the shank, D, and a left-handed thread, *a*, cut on the inside of the barrel, C, as shown in fig. 2.

To drive in a screw-nail, the jaws are made to embrace the head of the nail, and are compressed on to them by turning the barrel, C, to the right, the driver then being, as represented, inserted into the crease of the nail-head. By turning the stock, the barrel, C, and driver, revolving to the right, the crew is driven in rapidly and with great ease ; no hole is required to be made with a gimlet, previous to driving in the screw.

To release the jaws from the head of the screw, all that is necessary to be done is simply to grasp the barrel, C, firmly with the left hand and keep turning in the same direction. The slot, G, allows the driver to be forced beyond the jaws, when the barrel is grasped, and this relieves them.

To draw a screw from a counter-sink, the driver, E, is worked to project beyond the jaws (which is done by holding on to the barrel with the left hand and turning with the right), and then it is inserted into the crease of the head of the screw, and the stock is turned to the left, the barrel turning round with the driver. After the head is drawn out a short distance, the barrel, C, is held firm with the left hand, and the jaws are then left free, and allowed to grasp the head of the nail ; when this is done, the barrel, C, is turned round with the left hand to bring it down firm on the jaws, after which the driver, jaws, and barrel are turned to the left, and the screw is drawn out rapidly.

Bridges *versus* Steamboats.—A great excitement has prevailed on the Wheeling Bridge case, the height of it being insufficient to allow the steam-boat chimneys to pass. The Supreme Court ordered it to be taken down, but the Super-Supreme Senate have passed an act to legalise it, and so have quashed the decision. Are lowering chimneys unknown to the U. S.?

Steam Grain Elevator.—Messrs. Godard and Hovey, of Albany, have constructed a grain elevator, which appears to consist of a chain of buckets, &c., fixed in a boat. It will lift the grain out of one boat into another or into a granary, winnow it, clean it, and measure it at the rate of 15,000 bushels per hour.

Saw Frames.—The *Scientific American*, in quoting our account of Messrs. Worssams' timber-frame, notices our query as to the indicated power required, and says, " In America, five-horse power is allotted for driving a large rip-saw and a large circular saw. Gang-saws are now common in American saw-mills, but the common mode of working the reciprocating saw is nearly the same as Messrs. Worssams' frame. An engine of three-horse power will drive one of these saws, but it is best to leave a good margin of power as a surplus." We should allow considerably more than even three-horse (*nominal*) power to one of these heavy timber-frames—say ten-horse (indicated) power. We will repeat our question in a more definite shape :—With an average quality of saw, and a certain sort of timber, how many indicated horse power are required to saw a given number of superficial feet in a given time ?

Centrifugal Shot-making Machine.—Mr. Bonnet, of New York, has patented a shot-making machine, which consists of a circular revolving trough of iron, the periphery of which is perforated with holes. A pipe in the centre supplies the molten lead, which flies out at the holes, and is intercepted by a curtain hung round at a suitable distance. The machine makes 350 revolutions per minute, and is said to answer very well.

Rotary Engine.—Mr. E. Barrows has fitted his patent engine into a boat 70 feet long. The cylinder is 30 inches diameter and 12 inches long. With 45 lbs. of steam, she is said to run nine miles an hour against wind and tide.

Leather Paper is being made in the United States by Messrs. Forbes, straw and rags being added. Straw has been used in England for some time; but we believe there were difficulties in producing good qualities of paper, so that its use has been confined to the *inside* of cards, railway tickets, &c. The strength of the American paper to which we have alluded is, we are told by an English paper-maker, due to the absence of that severe bleaching to which all paper must be subjected to suit it to the English market.

STEAM-ENGINES IN PROGRESS OF CONSTRUCTION IN THE MORGAN WORKS.

One engine, 83-inch cylinder and 12 feet stroke, for ship building, by W. H. Brown and Son, to run on the Pacific.

One engine, 80-inch cylinder and 12 feet stroke, for boat building, by Bidwell, Banti, and Co., Buffalo, for M. O. Roberts, Esq.

One engine, 60-inch cylinder and 11 feet stroke, for ship, built by Wes-

tervelt and Son, for Charles Morgan, Esq., to run on Harris and Morgan's line, between New Orleans and Galveston.

One engine, 42-inch cylinder and 11 feet stroke, same builders, and for same parties as above, to run from New Orleans to Matagorda Bay.

One engine, 52-inch cylinder and 12 feet stroke, for boat building, by Mr. Samuel Sneiden, for New Haven line.

One engine, 44-inch cylinder and 11 feet stroke, for River Danube, to run from Vienna to Pesth. The boat is built of iron, and is owned by the Danube Steamboat Company, who have some sixty boats running to various points, and have extensive works of their own, employing about 1,200 hands.

One engine, 44-inch cylinder and 9 feet stroke, for Chicago Water-works, intended to force the lake-water to supply the city.

One engine, 40-inch cylinder and 14 feet stroke, for boat building, by Mr. Lawrence, for Mr. George Law.

Composition of Mortar.—It has been well ascertained that the mortar used by the ancients contained a much smaller quantity of lime than that now in use, but its admixture with the silex or sand is much more perfect or intimate. From the best accounts of their processes of making mortar, it appears that it was formed many months before being used; and placed in a pit dug in the ground, until wanted. After a few months it was taken up in a state nearly or quite untenacious, and beaten until it became perfectly soft or pliant, which, without the addition of water, will take place if sufficient labour be given in its manipulation. By this means every particle of silex or sand became coated evenly with the lime, and consequently it had a fair opportunity of bringing the particles within chemical distance of each other, which cannot be the case in the modern mode, of imply *hoeing* the mortar.

Bricks are usually covered with a slight coating of moulding sand, which is unattached; this should first be removed, or the mortar will attach itself to it, instead of the brick, and the want of this process will fully account for the *clean* condition of bricks when removed from walls built within the last fifty years. They should also be well washed and wetted before being used; by this means the excess of lime is partially taken up by the water, and on parting with the excess of water by evaporation, the lime forms a sort of dove-tail between the mortar and the capillary openings in the bricks. When we recollect the fact that seven hundred pounds of water are required to dissolve one pound of lime, it must be evident that the larger the quantity of water used, in the first instance, the more intimate must be the connection after its evaporation. When the bricks are dry, the mortar is robbed of its water before its parts are sufficiently connected with each other.

It is a common fault to require the use of a larger quantity of limethan is necessary, and, as labour is more expensive than lime, the master mason is very willing to accede to such a request; as, by a large addition of lime, the mortar becomes for the moment so malleable or soft, that a workman can lay fifty per cent. more bricks in the same space of time. Such excess, for want of intimate admixture, soon changes to carbonate of lime (isomeric with chalk), and being without a due proportion of silex, has no tenacity.

Sea sand should never be used; first, because it contains a quantity of chloride of sodium (common salt) upon the surface of the particles, which attracts moisture, and prevents its drying; and secondly, because from long attrition the particles become spherical (round) and thereby have less tenacity than in any other form. In the choice of sand for making mortar that which contains much loam should be particularly avoided, its particles being too minute for adhesion. Broken marble is an excellent substitute for sand, the shape of its particles being extremely irregular, and its surfaces so fresh and clean as to offer no opposition to adhesion.

RAILWAY SUSPENSION BRIDGE OVER THE NIAGARA RIVER.

The bridge will form a single span of 800 feet in length. It is to serve as a connecting link between the railroads of Canada and the State of New York, and to accommodate the common travel of the two countries. It is established by ample experience, that good iron wire, if properly united into cables or ropes, is the best material for the support of loads and concussions, in virtue of its great absolute cohesion, which amounts to from 90,000 to 130,000 lbs. per square inch, according to quality. The bridge will form a straight hollow beam of 20 feet wide and 18 deep, composed of top, bottom, and sides. The upper floor, which supports the railroad, is 24 feet wide between the railings, and suspended to two wire cables assisted by stays. The lower floor is 19 feet wide, and 15 feet high in the clear, connected with the upper one by vertical trusses, forming its sides, and suspended on two other cables, which have 10 feet more deflection than the upper ones. The anchorage will be formed by sinking 8 shafts into the rock, 25 feet deep. The bottom of each shaft will be enlarged for the reception of cast-iron anchor plates of 6 feet square. These chambers will have a prismatical section, which, when filled with solid masonry, cannot be drawn up without lifting the whole rock to a considerable extent. Saddles of cast iron will support the cables on the top of the towers. They will consist of two parts; the lower one stationary, and the upper one moveable, resting upon wrought-iron rollers. The saddles will have to support a pressure of 600 tons whenever the bridge is loaded with a train of maximum weight. The towers are to be 60 feet high, 15 feet square at the base, and 8 at the top. The compact, hard limestone used in the masonry of the towers will bear a pressure of 500 tons upon every foot square.

Weight of Bridge.

Weight of timber	910,130	lbs.
Wrought iron and suspenders	113,120	„
Castings	44,332	„
Rails	66,740	„
Cables between towers	534,400	„
	1,678,722	lbs.

Weight of Railroad Trains.

One locomotive	25	tons.
27 double-freight cars, each 25 feet long, and of 15 tons gross weight	405	„
Making a total gross weight of 430 tons, which will fall upon the cables when the whole bridge is covered by a train of cars from end to end; add to this 15 per cent. weight of pressure, as the result of a speed of five miles per hour, which is a very large allowance	61	„
Add weight of superstructure	782	„
Total aggregate maximum weight	1,273	tons.

The tension of cables, which result from a weight of 1,373 tons and an average deflection of 59 feet, is 2,340 tons. Since the assumed maximum tension can but rarely occur, it is considered ample to allow four times the strength to meet this tension—that is, 8,960 tons. But assuming 2,000 tons as a tension to which the cables may be subjected, five times the strength to meet it is allowed, and an ultimate strength of 10,000 tons provided for.

For this purpose 15,000 wires of No. 10 will be required. At each end of the upper floor the upper cables will be assisted by eighteen wire-rope stays, and their strength will be equivalent to 1,440 wires; these, deducted, leave the number of wires in the four superior cables 13,560, the number of wires in one cable 3,390, diameter of cable $9\frac{1}{4}$ inches. The railroad bridge will be elevated 18 feet on the Canadian, and 28 on the American, side, above the present surface of the bank, and above the present structure. It will be the longest railroad bridge, between the points of support, in the world.—*Canadian Journal.*

CHANNELS FOR INVESTMENT.

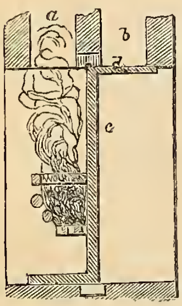
LIST OF NEW COMPANIES RECENTLY ESTABLISHED OR PROPOSED.

	Amount of Shares.	No. of Shares.	Capital.
London, Liverpool, and American Screw Steam Ship Company	£20	30,000	£600,000
Magdalena Steam Navigation Company	20	10,000	200,000
Albert Docks	10	50,000	500,000
Putney Bridge and Pier Company	20	3,250	65,000
Chatham and Canterbury Local Railway	20	15,000	300,000
Royal Swedish Railway Company	5	83,331	416,670
North and South Western and and City Junction Railway ..	20	11,500	230,000
Forth and Clyde Junction Railway Company	10	15,000	150,000
Orleans and Epernay Railway..	20	130,000	2,600,600
Londonderry, Enniskillen, and Sligo Railway	10	30,000	300,000
Red Dragon Silver-lead Mines	1	3,000	3,000
Poltimore Copper and Gold Mining Company	1	50,000	50,000
Viruenburg Copper Mines ..	1	75,000	75,000
Mizen-Head Copper Mines ..	1	20,000	20,000
The Waller Gold Mining Company	1	70,000	70,000
L'Aigle D'Or	1	75,000	75,000
Royal Hibernian	1	100,000	100,000
Tees Side (Lead) Mine ..	£1 5s.	4,800	6,000

	Amount of Shares.	No. of Shares.	Capital.
North Britain Burra Burra Copper Mine		5,000	
Royal Nassau Sulphate of Barytes Mines	£1 to be iss. at 10s. ..	68,000 ..	£34,000
South Alfred Consols Copper Mines	£1 ..	5,000 ..	5,000
Lake Fucino Draining Company	£17 10s. .	15,000 ..	262,500
City of London Sewage Manure Company	£10 ..	5,000 ..	50,000
Australian, Inland, Carrying, and Conveyance Company ..	1 ..	80,000 ..	80,000
The Great Paris Brewery ..	4 ..	25,000 ..	100,000

NOVELTIES.

Warming two Rooms with one Stove.—A correspondent inquires the best method of warming two rooms with one fire-place or stove. If a close stove is admissible, it may be done by carrying the smoke-pipe through the adjoining room; although, in that case, he must not mind the trouble of cleaning it out regularly. A very neat method of effecting the object is described in Bernan's *Warming and Ventilating*, which has the advantage of showing the fire in either room. The annexed sketch, a sectional elevation, will explain it. *a* is the chimney flue from one room, and *b* that of the other. A cast-iron plate, *c*, divides the two rooms, and has the fire-place attached to it. This plate is mounted on a pivot, top and bottom, and can, therefore, be turned round, so as to present either face to the room. A plate, *d*, is attached to the division plate to close up the flue on the side where the fire is not desired. When the fire is lighted, the division plate gets hot, and radiates a considerable quantity of heat into the next room; and whenever it is desired to increase the heat, the plate and fire-place can be turned round.



Prevention of Incrustation in Boilers.—Mr. Overman recommends to use charcoal to prevent incrustations in boilers. That made from hard wood is preferred, and is to be broken up into lumps from a quarter to half inch cube, and thrown into the boiler, in the proportion of two bushels to a boiler of 20 or 30 horse power. At the end of a month it will require to be renewed. It is said not to condense the salts of the fixed alkalies, as those of potash and soda, but it will effectually absorb all salts of lime, the alkaline earths, the salts of iron, and almost all other heavy metals.

NOTES FROM CORRESPONDENCE.

⁂ We cannot insert communications from anonymous correspondents.

"Mr. Isherwood, and H.M.S. *Arrogant*."—We have received a letter from Mr. I., in reference to our remarks at p. 234, in which he explains that the information respecting the *Arrogant* was given him by the chief engineer of the *Saranac*, who received it from the engineer of the *Arrogant*. We never suspected Mr. I. of any design to deceive the readers of his paper, but we certainly attached a meaning to his words which, it appears, they were not intended to convey.

"M. B., Newcastle."—A note of the claims of Mr. Crampton's patent will be found at p. 109 of the *Artizan*, 1847. The claims of another, dated 19th June, 1847, are given at p. 29, vol. 1848. Mr. C. has also a later patent, which will be found in our patent-list.

"Waterproof Paper."—A very excellent glazed paper is made in France, but we are not aware of the composition. Any of our correspondents who can give information on the subject will oblige "F. C." by doing so.

"C. E."—We have never seen any indicator diagrams up to 200 lbs. on the square inch from the American boats, but there is nothing impossible in getting that pressure in the cylinder if that in the boiler be slightly higher. There is no "easy way of indicating short-stroked direct-acting engines, moving at a great velocity." It is always a troublesome operation. M'Naught's indicators are the best that we know of.

"Mechanic," should send his invention to the Society of Arts exhibition, which opens in December. We are of opinion that air vessels should be small in diameter, and tall, so as to prevent the air mixing with the water as much as possible.

"G. B."—The subject has been fully discussed in our early vols. They are out of print, but he can perhaps borrow them.

Books Received.—*Treatise on the Screw Propeller*, by J. Bourne. *Illustrated Drawing Book of Practical Geometry*, by R. S. Burn. *On Jackson's Pretensions to the Invention of the Telegraph*, by A. Kendall, U. S.

LIST OF ENGLISH PATENTS,

From 23rd of October, to 13th of November, 1852.

Six months allowed for enrolment, unless otherwise expressed.

Robert M'Gavin, of Glasgow, Lanark, North Britain, merchant, for improvements in the manufacture of iron for ship-building. October 23.

Henry Needham Scrope Shrapnel, of Gosport, for improvements in extracting gold and other metals from mineral and earthy substances. October 23.

James Lamb, of Kingsland, Middlesex, gentleman, and Joseph Menday, of the same place, engineer, for improvements in the construction of kilns for burning or calcining cement, chalk, limestone, and other substances requiring such process, and in the application of the heat arising therefrom to the generation of steam. October 23.

Joseph Walker, of Dover, Kent, merchant, for improvements in treating cotton seeds, in obtaining products therefrom, and in the processes and machinery employed therein, parts of which improvements are applicable to distillation. (A communication.) November 2.

Patrick M'Anaspie, of Liverpool, gentleman, for a new manufacture of Portland stone cement and other compositions for general building purposes and hydraulic works. November 2.

John Crowther, of Huddersfield, York, for a self-acting hydraulic crane or engine for lifting weights, such weights when lifted to be used as motive power; as also for loading and unloading vessels and vehicles. November 2.

Louis Arnier, of Rue du Loisir, Marseille, France, engineer, for certain improvements in steam boilers. November 6.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, English and foreign patent agent, for certain improvements in the manufacture of certain articles of dress. (Being a communication.) November 6.

Charles Liddell, of Abingdon-street, Westminster, Esquire, for improvements in electric telegraphs. November 11.

John Weems, of Johnstone, Renfrew, North Britain, for improvements in the manufacture or production of metallic pipes and sheets. November 11.

Andrew Fulton, of Glasgow, Lanark, North Britain, hatter, for improvements in hats and other coverings for the head. November 11.

William Petrie, of Woolwich, Kent, civil engineer, for improvements in obtaining and applying electric currents, and in the apparatus employed therein; part or parts of which improvements are applicable to the refining of certain metals, and to the production of metallic solutions, and of certain acids. November 13.

LIST OF SCOTCH PATENTS,

From 26th of August to 21st September, 1852.

Thomas Richardson, of Newcastle upon Tyne, for improvements in the manufacture and preparation of magnesia and some of its salts. August 26.

James Warren, of Montague-terrace, Mile-end-road, gentleman, for improvements applicable to railways and railway carriages, and improvements in paving. August 26.

Alexander Parkes, of Birmingham, for improvements in separating silver from other metals. August 26.

Frederick Sang, of Pall-Mall, Middlesex, artist in fresco, for improvements in floating and moving vessels, vehicles, and other bodies in and over the water. August 26.

Joseph Denton, of Prestwich, Lancaster, gentleman, for certain improvements in machinery or apparatus formanufacturing looped, terry, or other similar fabrics. August 26.

Joseph William Schlesinger, of Brixton, Surrey, gentleman, for improvements in firearms, in cartridges, and in the manufacture of powder. (Partly communication.) August 26.

Alexander Stewart, of Glasgow, manufacturer, for improvements in the manufacture or production of ornamental fabrics. August 27.

Sir John Scott Lillie, companion of the Honourable Order of the Bath, of Pall-Mall, for certain improvements in the construction or covering of walls, floors, roads, footpaths, and other surfaces. August 31.

Pierre Isidore David, of Paris, machinist, for certain improvements in the method of bleaching, and in the apparatus connected therewith. September 1.

Joshua Crockford, of Southampton-place, Middlesex, gentleman, for improvements in brewing and in brewing apparatus. September 2.

Thomas Wilks Lord, of Leeds, York, flax and tow machine-maker, for improvements in machinery for spinning, pressing, and heckling flax, tow, hemp, cotton, and other fibrous substances, and for the lubrication of the same, and other machinery. September 2.

Edmund Morewood and George Rogers, of Enfield, gentlemen, for improvements in the manufacture, shaping, and coating of metals, in applying that metal to building purposes, and the means of applying heat. September 6.

George Wright, of Sheffield, and also of Rotherham, York, artist, for improvements in stoves, grates, or fire-places. September 11.

Thomas Hunt, of Leman-street, Goodman's-fields, Middlesex, gentleman, for improvements in fire-arms. September 13.

Alexander Mills Dix, of Salford, Lancaster, brewer, for certain improvements in artificial illumination, and in the apparatus connected therewith, which improvements are also applicable to heating and other similar purposes. September 16.

John M'Conochie, of Liverpool, Lancaster, engineer, for improvements in locomotive and other steam engines and boilers, in railways, railway carriages and their appurtenances, also in machinery and apparatus for producing part or parts of such improvements. September 20.

Robert Burn, of Edinburgh, practical engineer, for a certain improvement in steam engines. October 6.

Thomas Ellwood Horton, of Priors Lee Hall, Salop, iron-master, and Elisha Wylde, of Birmingham, engineer, for improvements in apparatus for heating and evaporating. October 12.

Robert M'Gavin, merchant, for improvements in the manufacture of iron for ship-building. October 21.

LIST OF IRISH PATENTS,

FROM THE 28TH OF SEPTEMBER TO THE 13TH OF OCTOBER, 1852.

Frederick Sang, of Pall-mall, Middlesex, artist in fresco, for certain improvements in floating and moving vessels, vehicles, and other bodies on and over water. September 28.

Thomas Ellwood Horton, of Priors Lee Hall, Salop, iron-master, and Elisha Wylde, of Birmingham, engineer, for improvements in apparatus for heating and evaporating. October 13.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS DEPOSITED.

Auguste Chesneau. The manufacture of an indestructible paving. October 12.

William Chisholm. Improvements in the purification of gas, and the obtention of certain products during the process of such purification. October 14.

George William Lenox. Improvements in machinery for raising and lowering cables and other chains. October 18.

William Roberts. Improvements in machinery for stopping and lowering cables and other chains. October 18.

Halsey Draper Walcott. A new and useful, or improved mechanism or contrivance for cutting button-holes or slits in cloth, or other material. October 26.

Frederick Richards Robinson. An improvement in the gridiron, or instrument for cooking steak or other articles by broiling. October 20.

Thomas Potts, improvements in the manufacture of hinges, and in machinery for producing the same. October 27.

George William Ley, for a method of imitating carvings in wood. November 3.

Marc Klotz, for an improved process or apparatus to be employed in ornamenting fabrics, leather and other surfaces. November 4.

William Thomas Henley, for certain improvements in electric telegraphs, and in apparatus and instruments connected therewith. November 9.

DESIGNS FOR ARTICLES OF UTILITY,

FROM THE 23RD OF OCTOBER, TO THE 16TH OF NOVEMBER, 1852.

Oct. 23, 476, Thomas Allan, Adelphi-terrace, "Battery plate-frame."
,, 30, 3380, W. Caldwell, Glasgow, "Berth settee."
Nov. 2, 3381, G. Duncan, A. Hutton, and C. Thomas, Chelsea, "Spring-holder strap."
,, 2, 3382, Clark and Timmins, Bloomsbury-street, "Table fasteners."
,, 6, 3383, J. D. Everett, Totteridge, Protean puzzle.
,, 9, 3384, Robert Lambert, Goree Piazza, Liverpool, and Thomas Danby, Toxteth-park, Liverpool, gold sifter.
,, 10, 3385, William Taylor, Birmingham, inside shutter-bar.
,, 11, 3386, Dobson and Barlow, Bolton-le-Moors, "Upper part of a weight book for lapping machines."
,, 12, 3387, George Hyde, Fleet-street, "Portable writing case."
,, 16, 3388, D. and E. Bailey, High Holborn, "Smoke-guard."
,, 16, 3389, B. Cogswell, Strand, "Six-shot rifle-pistol."

PROVISIONAL PROTECTIONS UNDER THE NEW LAW.

Dated October 1, 1852.

8. Richard Wright. Improvements in constructing vessels.
58. William Willcocks Sleigh. An invention for producing motive power, which he entitles "The Counteracting Reaction Motive Power Engine."
63. George Ellins. An improved method or apparatus for preparing flax straw for dressing and cleaning.

Dated October 2, 1852.

147. Edwin Whele. Improvements in apparatus for burning candles, and in horological apparatus attached thereto.
148. Edward William Kemble Turner. Certain improvements in machinery for sweeping or cleaning chimneys; also for more effectually extinguishing them when on fire.
149. Edwin Whele. An improved rotary engine, to be worked by steam, air, or gases.
150. Thomas Boyd. Improvements in the treatment or finishing of woven fabrics.
151. David Wilkinson Sharp. Improvements in machinery for combing and drawing a sliver of wool, flax, silk-waste, and other fibrous substances, and in apparatus for constructing screws to be used in a part or parts of such machinery.
152. Eugene De Varroc. Improvements in rendering glass reflective.
153. David Stephens Brown. An agricultural implement for tilling the soil.
154. David Stephens Brown. Obtaining useful products from sewers.
155. David Stephens Brown. An improved means of navigating the water by ships.
156. Joseph Brown. Improvements in beds, sofas, chairs, and other articles of furniture, to render them more suitable for travelling and other purposes.
157. James Mayelston. Improvements in the method of applying heat to the heating of water for feeding or supplying the boiler or boilers of steam engines, or for other purposes.
158. Francis Prime Walker. Improvements in machinery for communicating signals to the drivers of railway engines.
159. Benjamin Fothergill. Improvements in certain machinery for preparing to be spun, cotton, wool, flax, silk, and other fibrous substances.
160. Joseph Burch. Certain improvements in building and propelling ships and vessels.
161. Richard Archibald Brooman. Improvements in purifying and disinfecting fats and fatty bodies, and in separating oleine from stearine.
162. John Ignatius Fuchs. An electro-magnetic apparatus.
163. Moses Poole. Improvements in the manufacture of tables, sofas, bedsteads, stands, chairs, and other articles of furniture, and the frames and bodies of musical instruments.
164. John Robert Johnson. Improvements in fixing colouring matter of madder in printing and dyeing.
165. Moses Poole. Improvements in constructing bridges, viaducts, and such like structures.
166. Samuel Powell. Improvements in the manufacture of certain articles of wearing apparel.
167. Joseph Faulding. Improvements in machinery for sawing and cutting wood and other substances.
168. John Macintosh. Improvements in compositions to be used as paints.
169. Moses Poole. Improvements in machinery for mowing and reaping.
170. Edward Allport. An improvement in the manufacture of buttons, by making them with elastic shanks.
171. William James Lewis. A slideless stadia sight, applicable to rifles and other fire-arms.
172. John Jobson. Improvements in manufacturing moulds for casting metal.
173. Theophilus Redwood. Improvements in the manufacture of gelatine.
174. Alexander Campbell Duncan. Improvements in the art or process of dyeing cotton or other textile fabrics, or cotton or other yarns, when printed or mordanted with the colouring matter of madder or of dye woods, and in machinery or apparatus employed therein.
175. Michael Cavanagh. Certain improvements in mortice-lock spindles.
176. Peter Hyde Astley, and John Figgins Stephens. An improved construction for floating vessels, having for its object the rendering them safe means of transit.
177. William Simpson, and John Shelton Isaac. An improved composition, to be used principally as a substitute for wood or other materials, where strength and lightness are required in the manufacture of various articles.
178. William Edward Newton. Improvements in stoppers for bottles and other similar vessels.
179. Frederic Newton. Improvements in the apparatus to be employed for producing photographic pictures.
180. John Slack. Improvements in the manufacture of textile fabrics.
181. William Edward Newton. Improvements in governors or regulators for regulating the pressure of gas as it passes from the main or other pipes to the burners.
182. Samuel George Archibald. An improved mode of extracting or rendering animal fats and oils.
183. Thomas Green. Improvements in the construction of omnibuses.
184. Joseph Needham. Improvements in breech-loading fire-arms, and in apparatus connected therewith.
185. James Edward MacConnell. Improvements in sheathing iron vessels, and in covering, lining, or coating sheets or other manufactured articles of iron or steel.
186. John Burnie. Improvements in cutting or reducing vegetable substances.
187. Alexander Miller. Improvements in the treatment or finish of textile fabrics and materials.
188. John Weems. Improvements in obtaining and applying motive power.
189. Alexander Willison. Improvements in thrashing machinery.
190. James Anderson Young. Certain improvements in dental operations, and in apparatus or instruments to be used therein.
191. John Stringfellow. Improvements in galvanic batteries, for medical and other purposes.
192. George John Philps. Improvements in hats and other like coverings for the head.
193. Ralph Errington Ridley. Improvements in cutting and reaping machines.
194. Thomas Lawrie. Improvements in forming and protecting inscriptions and devices in exposed situations.
195. George Stuart. Improvements in heating the fleeces of natural coverings of sheep and other animals when on the animals.

Dated October 4, 1852.

197. John Gooch Marshall. Improvements in rendering weather-tight doors, casements, and other similar openings.
199. Edwin Bates. Certain improvements for deriving motive power from expansive fluids, and the better application and economy thereof for propelling ships and other vessels in sea, river, and canal navigation, also in the shape and action of wind-sails, the use of water as a motive power for driving machines, mills, &c., the construction of turbines, air and water pumps, marine pumps for emptying ships of bilge water, and other useful purposes.
200. Edward Welch. Improvements in fire-places and flues, and in apparatus connected therewith.
201. Martin Watts. Certain improvements in machinery or apparatus for roving or preparing cotton and other fibrous substances for spinning.
202. William Hayward West. Improvements in wind-guards and chimney-tops.
203. Robert Hazard. A calorific bath.
204. Bendix Ising Jacoby. Improvements in the means of fixing artificial teeth.
205. Martin Billing. Certain improvements in the combination of metals having different capacities of vibration, to be used in the construction of certain useful articles.
206. John Moseley. Certain improvements in machinery for cleansing linen and other fibrous materials.
207. William Donald Napier and William Lund. Improvements in apparatus for steering vessels.
208. Richard Manwaring and Thomas Hamblin. Improvements in ploughs.
209. James Barrow Storey. Improvements in mouth-pieces for pipes and cigars.
210. Henry Webb and Joseph Froysell. Improvements in fastening knobs to door and other locks.
211. Thomas Scott. Improvements in applying and transmitting motive power, and in accelerating the progress of bodies in motion.
212. Thomas Slater and Joseph John William Watson. Improvements in the application of electricity to illuminating purposes.
213. Antoine François D'Henin. Improvements in the treatment and manufacture of tobacco.
214. Thomas Kennedy. Improvements in obtaining and applying motive power, which improvements, or parts thereof, are applicable to time-keepers and clockwork, and for measuring and registering the flow of water and other fluids and aëriform bodies.
215. John Erskine. Improvements in the manufacture of felted and cemented fabrics.
216. Archibald Brown. Improvements in the construction of sheaves for blocks.

Dated October 5, 1852.

217. Michael Angelo Garvey. An invention for more effectually dissipating the shock of collision in railway trains, reducing the surfaces exposed to atmospheric resistance, and diminishing oscillation by making portions of the whole of each carriage elastic in every direction, and increasing the power of the carriage to resist severe pressure by means of metallic tubes in its longitudinal angles.
218. William Clark. Improvements in the construction of screw propellers for propelling vessels.
219. Arthur Richard Burr. Certain improvements in making gun and pistol barrels, applicable to the manufacture of other kinds of tubes.
220. David Stephens Brown. An improved apparatus or instrument for evaporating or distilling liquids.
221. William Crosskill. Improvements in machines for cutting or reaping growing corn, clover, and grass.
222. Aristide Balthazard Berard. Improvements in the construction of jetties, break-waters, and docks, and other hydraulic constructions.
223. John Houston. Improvements in obtaining motive power when air and steam are used conjointly.
224. John Houston. Improvements in metallic spring packings for pistons.
225. Joseph Apsey. Improvements in ship-building and in machinery for propelling.
226. Diego Jimenez. Improvements in the manufacture of soap.
227. Benjamin Mitchell. Improvements in the construction of artificial legs.
228. William Edward Newton. Improvements in machinery for boring or cutting rocks or other hard substances, for the purpose of tunnelling through mountains, or making other excavations.
229. William Edward Newton. Improvements in the means of producing a vacuum for various purposes, such as condensing steam, pumping water, exhausting air, or other purposes where a vacuum is required.
230. James Bullough, David Whittaker, and John Walmesley. Improvements in sizing machines.
231. George Walker Nicholson. Improvements in screw-bolts, nuts, and washers, and in the machinery or apparatus for making the same.

232. John Prestwich, the elder, Samuel Prestwich, and John Prestwich, the younger. Improvements in machinery or apparatus for cleaning and finishing woven fabrics.
233. William Crook. Improvements in looms.
234. John Balmforth, William Balmforth, and Thomas Balmforth. Improvements in steam boilers, and in fixing the same.
235. Adam and John Booth. Improvements in platting or braiding-machines, which machines are applicable to manufacturing webs for making door and other mats.
236. Robert Brown. An improved taking-up motion, applicable to looms and other similar purposes.
237. Herm Jäger. Improvements in the treatment of cotton and other similar fabrics, by the introduction of chemical agents to supersede the use of dung in the dunging process.
238. William Gilbert Elliott. Improvements in the manufacture of bricks, pipes, tiles, and other articles capable of being moulded.
239. Pierre Frederic Gougy. Improvements in paving streets, roads, and ways.
240. Thomas Turnbull, Improvements in the preparation and treatment of flax, hemp, and other similar vegetable fibres.
241. Jesse Ross. Certain improvements in machinery or apparatus for combing wool, cotton, silk, flax, and other suitable fibrous materials.
242. William Mackenzie. Improvements in the arrangement and construction of graduated scales for measuring instruments.
243. Samuel Getley. Improvements in water-closets.
244. Joseph Westby. Improvements in machinery applicable to the manufacture of lace and other weavings.
245. William Dray. Improvements in machinery for reaping and mowing.
246. George Hallen Cottam. Improvements in chairs, sofas, and bedsteads.
247. Christopher Nickels and Frederick Thornton. Improvements in weaving.

Dated October 6, 1852.

248. James Bird. A new artificial manure.
249. John Hughes. An improved method of constructing roofs and sides of houses, buildings, and other structures.
250. William Armand Gilbee. An improved mode of disinfecting putrified and fecal matters, and converting fecal matters into manure, also applicable to the disinfection of cesspools, drains, sewers, and other similar receptacles.
251. Auguste Edouard Loradoux Bellford. Improvements in sewing-machines.
252. Jacob Tilton Slade. An improved mode of driving certain machines, and an improved driving-band or chain to be used therewith.
253. Charles de Bergue. Certain improvements in machinery for punching metals, and for riveting together metallic plates or bars.
254. Robert Shaw. Pre-arranging, ascertaining, and registering the rate of travelling of locomotive engines, and of railway or other carriages.
255. John Crook and John Wilkinson Wood. Certain improvements in the method of preserving iron from oxidation or decay.
256. John Cronin Jeffcott. An invention for producing heat for generating steam, and applicable to and for other purposes for which this invention has not been hitherto used, under the name and title of a heat-producer and steam-generator.
257. Alexis Delemer. Improvements in machinery or apparatus for manufacturing piled fabrics.
258. David Chalmers. Improvements in looms for weaving wire web or cloth by power.
259. George Walker Nicholson. Improvements in vices, and in the means or method used for fixing the same.
260. William Coles Fuller, and George Morris Knevitt. Certain improvements in applying India-rubber or other similarly elastic substance as springs for carriages.
261. William Abbott. An improved plough.
262. Robert Mortimer Glover, and John Cail. Improvements in miners' or safety lamps.
263. John Gaylord Wells. An improved construction of self-inking stamping apparatus.
264. Alfred Vincent Newton. Improvements in apparatus for manufacturing gas and coke.
265. David Collison. Improvements in the construction of shuttle skewers.
266. Henry Alfred Jowett, and Frederick William Jowett. Improvements in apparatus for heating, which improvements are particularly applicable for generating steam or evaporating solutions, and may be applied for heating purposes generally.
267. Thomas Barker Walker Gale, and Jonathan Fensom. Improvements in the means of joining or coupling bands or straps.
268. William Crosby. Improvements in the ventilation of coal-pits and mines, ships' rooms, and buildings generally.
269. William Vaughan Morgan. Improvements in the preparation of oils for the purposes of illumination and lubricating machinery
270. John Grimes. An atmospheric freezing machine.
271. Joseph Westby. Improvements in twist lace machinery.
272. Joseph Hill. A machine for stamping metals and forging iron and steel.
273. John Frederick Chatwin. Improvements in the manufacture of brushes.
274. John Frederick Chatwin. Improvements in the manufacture of buttons.
275. Alphonse René le Mire de Normandy. Improvements in obtaining fresh water from salt water.
276. Francis Warren. Improvements in gas-burners.
277. Admiral the Earl of Dundonald. Improvements in coating and insulating wire.
278. William Adolph. Improvements in apparatus for warming and ventilating rooms.
279. James Clark. Improvements in weaving carpets and other fabrics, and in the machinery or apparatus employed therein.

Dated October 7, 1852.

280. William Bissell. An improved cramp, or improved cramps, for cramping floors, doors, and joiners' and ship work generally.
281. Samuel Perkes. Certain improvements in the mode of treating skins, hides, leather, and other manufactured and raw productions.
282. John Blair. Certain improvements in the manufacture of waddings, and in the machinery for making the same.
283. Thomas Greaves. Improvements in the method or means of obtaining and employing motive power.
284. George Simpson. Certain improvements in machines or apparatus for weighing.
285. Edwin Pettit, and James Forsyth. Improvements in spinning and drawing cotton and other fibrous substances, and in machinery for that purpose.
286. Auguste Edouard Loradoux Bellford. An improvement in smoothing irons.
287. Auguste Edouard Loradoux Bellford. Improvements in steam boilers.
288. Augustus Waller. Improvements in the means of measuring or ascertaining the quantity of alcohol and other substances in brandy, wine, beer, and other liquids.
289. John Tatham, and David Cheetham. Improvements in rollers or bosses used for drawing or conveying textile materials and fabrics.
290. William Horsfield. Improvements in splitting, crushing, and grinding corn, seeds, grain, minerals, or other substances.
291. Morris Lyons. Certain improvements in coating the surfaces of iron.
292. Samuel Rainbird. Improvements in grappling and raising sunken vessels and other submerged bodies, and in apparatus for that purpose.
293. John Little. Improvements in ashpans for fire-grates, stoves, and fire-places.
294. Mitchel Thompson. Improvements in lamps, and in the production of artificial light.
295. Peter Ward. Improvements in the manufacture of sal-ammoniac and obtaining salts of ammonia.
296. Alfred Trueman. Improvements in obtaining copper and other metals from ores or matters containing them.
297. Alfred Kent. Improvements in glazing.

Dated October 8, 1852.

298. Edward Joseph Hughes. An improved method of purifying and concentrating the colouring matter of madder, munjeet, and spent madder.
299. Thomas Pascall. Improvements in ridge tiles and roofing.
301. Samuel Smith. Certain improvements in looms for weaving.
302. William Townley. Improved machinery or apparatus for watering and flushing streets, squares, courts, and other localities.
303. George Tillett. Certain improvements in bedsteads,
304. John Patterson. Improvements in buckles or fastenings.
305. John Talbot Tyler. Improvements in hats, and in the preparation of plush or other covering used in the manufacture of hats.
306. John Talbot Tyler. Improvements in velouring machines, or machines used by hatters for causing the covering of hats to adhere to the body, and for polishing the nap of hats.
307. George Ennis. Improvements in dredging machines.
308. John Lewthwaite. Improvements in cards and tickets, and in machinery for cutting, printing, numbering, and marking cards, tickets, and paper.
309. James Yule. An improved arrangement of sawing machinery.
310. William Edward Newton. Improvements in the construction of hydraulic rams.

Dated October 9, 1852.

311. Auguste Edouard Loradoux Bellford. Improvements in apparatus for manufacturing soda-water and other aërated liquids.
312. James Bird. A new manufacture of cement.
313. John Egan. A self-acting flax scutching and hackling machine with horizontal blades or hackles, an incline plane on which flax-holders move, the application of the fan by a current of air to press flax against scutching blades or hackles, and spring catch flax-holders, as per drawing.
314. Richard Husband. Certain improvements in weaving hat plush and other textile fabrics.
315. Alexander Clark and Patrick Clark. Improvements in the manufacture of shutters, doors, and windows.
316. Antoine Burg. Certain instruments, apparatus, and articles for the application of electro-galvanic and magnetic action for medical purposes.
317. William Scolfield, and Joseph Pritchard. Improvements in steam boilers.
318. William Maddick. An improved method of extracting and concentrating by evaporation the colouring and other principles from all substances in which they are contained, and of thoroughly exhausting the same.
319. James Johnson. Improvements in heating, ventilating and sewering cottages or dwelling-houses.
320. John and William Smith. Improvements in the method or process of dyeing woven or textile fabrics certain colours, and in machinery or apparatus employed therein.
321. Samuel Hardacre. Improvements in machinery or apparatus for blowing, scutching, opening, cleaning, and sorting cotton, wool, and other fibrous substances, parts of which improvements are applicable to other purposes.
322. George Gent. A fruit cleaning and dressing machine.
323. Jean Jemot Rousseau. Improvements in inlaying and ornamenting metal plates to be used for door plates, sign plates, and other purposes to which such inlaid or ornamented plates may be applicable.
324. Thomas Restell. Certain improvements in chronometers, watches, and clocks, part of which improvements is applied to roasting jacks.
325. John Henry Johnson. Improvements in composing and distributing type.
326. Charles William Siemens. Improvements in engines to be worked by steam and other fluids.
327. Jonas Lavater. Improvements in the apparatus for measuring the inclination of plane surfaces and angles formed or to be formed thereon.
328. William Hine. Improvements in machinery applicable to paddle-wheels, windmills, and other useful purposes.

Dated October 11, 1852.

329. Auguste Edouard Loradoux Bellford. Improvements in the construction of revolving or repeating fire-arms.
330. Henry Moorhouse. Improvements in machinery or apparatus for cleaning woollen, cotton, or linen rags and waste, which machinery or apparatus is applicable to cleaning and tempering clay, or other similar purposes.
331. David Laidlaw. Improvements in the manufacture or production of gas burners.
333. George Searby. Improvements in machinery for cutting, carving, and engraving wood, stone, metal, and other suitable materials.
334. George Searby. An invention of the cure of smoky chimneys, and the prevention of accumulation of soot in flues.
335. Robert Cochrau. Improvements in kilns.
336. Charles Matthew Barker. Improvements in sawing wood.
337. Henry McFarlane. Improvements in stoves or fire-places.
338. Robert Lambert. Improvements in tents.
339. Andrew Edmund Brae. Improvements in the means of, or apparatus for, exhibiting numbers, letters, dates, or other devices for various purposes.
340. Henry Dewy. Improvements in disengaging ships' boats from their suspending chains or ropes.

Dated October 12, 1852.

341. Edward Simons, Improvements in lamps.
342. Francis Alexander Victor Michel. Stereotyping in copper by the galvanoplasty.
343. John William Couchman. The closing and hanging of swing and other doors, by means of the spring and pivots.
344. Samuel Perkes. Improvements in certain apparatus and machinery for the production and treatment of mineral and other substances, and part of which are applicable for other useful purposes.
345. Samuel Perkes. Certain improvements in navigable vessels and propellers.
346. Samuel Perkes. Certain improvements in mines, buildings, and sewerage for effecting sanatory purposes and reating the produce therefrom.
347. Auguste Edouard Loradoux Bellford. Improvements in sewing cloth and other materials.
348. Joseph Humphreys. Improvements in metallic and other designs for exhibition in or on shop and other windows and places.
349. Emanuel Wharton. Certain improvements in metallic bedsteads.
351. Louis Constant Alexandre Vittrant. Improvements in the preservation of vegetable and animal matters.
352. Thomas Dawson. Improvements in the means of cutting pile or terry fabrics.
353. Thomas Lacey. Improvements in apparatus for raising liquids, and in joints for uniting India-rubber and other like flexible tubing.
354. Joseph Walker. Improvements in machinery for crushing and bruising malt, grain, and seeds.

355. Peter Warren. An improved material, applicable to many purposes for which papier maché and gutta percha have been or may be used.
356. Joseph Robinson. Improvements in ventilators.
357. Thomas Barnabas Daft. Improvements in inland conveyance.
358. William H. Smith. Improvements in the manufacture of lava ware.
359. Léon Godefroy. Improvements in covering or packing rollers for printing fabrics.

Dated October 13, 1852.

360. George Lloyd. An improvement or improvements in the manufacture of paper.
361. Joseph Pimlott Oates. An improved spring or improved springs, for carriages.
362. William Tatham. An improved mode or improved modes, of preventing accidents on railways.
363. John Carter. Improvements in the manufacture of woven fabrics.
364. Matthew Smith. Improvements in machinery for weaving and printing.
365. Edward Lloyd. Certain improvements in steam engines, the whole or part of which improvements are applicable to other motive engines.
366. Joseph Nash. An invention of the treatment and refining of sugar.
367. Peter Armand Le Comte de Fontaine Moreau. A certain chemical combination for the silicatisation of calcareous matters.
368. William Walker Stephens. The application of retorts in gas ovens, or other ovens, to a process of improving iron, and converting iron into steel.
369. Thomas Suttle. Improvements in roasting apparatus.
470. Robert Pinkney. Improvements in cases for holding marking materials.
371. Walter McFarlane. Improvements in water-closets.
372. Richard Williams. An improvement or improvements in pumps or pumping.
373. Pierre Josephe Rousset Coquerelle. The combination of certain chemical agents for the replacing of indigo and other blues, which combination he calls Rousset Blue.
374. Christopher Hill. Improvements in the manufacture of lubricating matters.
375. Gerard Andrew Arney. Improvements in coating or enamelling pictures, prints, paper, and other surfaces.
376. Henry McFarlane. Improvements in constructing metal beams or girders.
377. Martyn John Roberts. Improvements in galvanic batteries, and in obtaining chemical products therefrom.
378. Preston Lumb. Improvements in apparatus for cleansing coal.
379. John Henry Lee. Improvements in sawing.

Dated October 14, 1852.

380. Alfred Augustus de Reginald Hely. An improved waiter or tray.
381. Thomas Brown and John Cox. Certain improvements in the mode of heating retorts or ovens, for the manufacture of gas, and other distillatory products of coal.
383. Donald Grant. Improvements in the means of applying the heat derived from the combustion of gas.
384. Joseph Henry Tuck. Improvements in stuffing-boxes, and in packing to be used in stuffing-boxes, bearings, pistons, and valves.
385. Louis Rossi. An improved manufacture of muffs, boars, tippets, and other like articles.
386. John Duncan. Improvements in the treatment or manufacture of textil materials.
387. Joseph Major. An invention of removing spavins, ringbones, curbs, splents, and other natural ossifications and humours from horses, which invention he names Major's Celebrated British Remedy.
388. Alsop Smith. Improvements in the manufacture of firewood.
389. James Webster. Improvements in the construction of springs.
390. John Swindells and William Nicholson. Improvements in obtaining oxygen gas, and applying it in the manufacture of various acids and chlorine, for oxidating metallic solutions, and for ageing and raising various colouring matters.
391. Eugène André Boutarel. Improvements in ornamenting and applying colour to fabrics.

Dated October 15, 1852.

392. Joseph Burch. Certain improvements in baths and bathing.
393. Joseph Burch. Certain improvements in building ships and vessels, and for the purposes of saving lives and property in cases of shipwreck or fire at sea.
394. Robert Hawkins Nicholls. An invention for horse-hoeing land.
395. John Gedge. An improved stove or heating apparatus.
396. James Lochhead and Robert Passenger. Certain improvements in the manufacture of glass and other vitrified substances, and in ornamenting and annealing the same.
397. Henry Moseley. A machine to be driven by the pressure of a fluid, or to displace a fluid, or to measure it.
398. Hermann Turck. Improvements in propelling vessels.
399. Joseph Hopkinson. Improvements in steam boilers.
400. Simon Pincoffs and Henry Edward Schunck. Improvements in the treatment of madder and other plants of the same species, and of their products, for the purpose of obtaining dyeing materials.
401. William Edward Newton. Improvements in washing and amalgamating gold and other metals.
402. John William Branford. Improvements in fire-escapes.
403. Jeremiah Driver and John Wells. Improvements in moulding in sand and loam, for the casting of iron and other metals.
404. William Stevenson. Improvements in weft forks for power looms.
405. Allan Edwin Hewson. Certain improved modes or processes for making buttons, beads, and other ornaments of dress.
406. Andrew Blair. Improvements in printing and ornamenting fabrics.
407. Charles Henry Waring. Improvements in the cutting and working, or quarrying of coal, stone, shale, clay, and other similar substances, and in machinery for that purpose.

Dated October 16, 1852.

409. Evan Leigh. Certain improvements in machinery or apparatus for carding cotton and other fibrous materials.
410. Lot Faulkner. Certain improvements in the method of obtaining motive power.
411. Jerome André Drieu. Certain improvements in weaving cloth, to be employed in the manufacture of stays.
412. John Howard. Certain improvements in the construction of steam-boilers or steam-generators.
413. Charles Tiot Judkins. Improvements in machinery or apparatus for sewing or stitching.
414. John Woods. Improvements in screw stocks.
415. William Beckett Johnson. Improvements in stationary steam engines.
416. Isaac Atkin. An improved machine for the manufacture of looped fabrics.
417. Pierre Augustin Puis. An improved chain or cable, and an apparatus employed therewith for certain applications.
418. John Henry Johnson. Improvements in the manufacture of sugar.
419. John Henry Johnson. Improvements in the manufacture and applications of hyposulphite, and similar compounds of zinc.
420. John Oliver York. Improvements in connecting and in fixing rails in railway chairs

Dated October 18, 1852.

421. Charles Reeves, junior. An improvement or improvements in the manufacture of knives.
422. George Randfield Tovell, and John Mann, junior. Improvements in the construction of ships and other vessels.
423. Samuel Fletcher Cottam. Improvements in quarrying slate.
424. John Henry Johnson. Improvements in drying, and in the machinery or apparatus to be used therein.
427. Auguste Edouard Loradoux Bellford. Improvements in the manufacture of fuel, part of which improvements are applicable to the manufacture of gas and soda, and freeing metals from extraneous substances.
428. John Campbell. Improvements in the treatment or finishing of textile fabrics and materials.
429. William Harcourt, and Joseph Harcourt. Certain improvements in the construction and manufacture of match-boxes.
430. Richard Archibald Brooman. Improvements in vices.
431. Henry Hughes, and George Firmin. Improvements in the manufacture of lamp-black, and in recovering from such manufacture a substance suitable for fuel.
432. Edwin Heywood. Improvements in looms.
433. John Lyons McLeod. Improvements in giving a metallic coating to iron ships' bottoms and other surfaces.

Dated October 19, 1852.

434. Thomas William Greathead, James Hilliard, and John George Reynolds. An improved means of heating, cooking, and warming.
435. John Goodman. An improved fountain pen.
436. Robert Mole and Robert Mole, junior. Improvements in the manufacture of swords and matchets.
437. Arthur James. An improvement or improvements in needle-cases or wrappers.
438. Joseph Harcourt and William Harcourt. The application of porcelain, glass, or earthenware to articles in which, or for which, those materials have never heretofore been used.
439. Martin Walter O'Byrne and John Dowling. An invention of a machine for cutting paper, mill-board, leather, vellum, sheet metals, and other suitable materials for useful and ornamental purposes.
440. Fennell Herbert Allman. Certain improvements in the manufacture and construction of brushes.
441. John Kealy. Improvements in machinery or apparatus for cutting or slicing roots.
442. William Newton. An improved machine for separating ores, metals, and other heavy substances, from mud, sand, gravel, stones, and other impurities.
443. William Chisholm. Improvements in obtaining caustic soda and other substances from the residues of articles used in the purification of gas.
444. Gabriel Benda. Improvements in apparatus for obtaining fire for smokers.
445. George Gotch. Certain improvements in transmitting intelligence upon railways.
446. Robert Bird. Improvements in the straining-webs of saddles.
447. George Gadd. Improvements in apparatus for roasting coffee.
448. James Otams. Improvements in the manufacture of manure.
449. John Jones. Improvements in handles for knives, razors, and other like instruments.

Dated October 20, 1852.

450. George Heyes. Improvements in the manufacture of fancy woven or textile fabrics, and in the machinery or apparatus connected therewith.
451. Robert Brown. Certain improvements in the method of ventilating buildings or apartments, and in the apparatus connected therewith.
452. John Carnaby. Apparatus for turning, managing, and regulating the main taps of gas pipes laid on to houses or buildings, at a part of the house or building distant from the main tap.
454. Charles Clarke and John Gilbert. Improvements in the supply and distribution of water and other fluids
455. Auguste Edouard Loradoux Bellford. Improvements in cocks or taps.
456. Anthony Liddell. Improvements in stuffing-boxes and pistons.
457. Auguste Edouard Loradoux Bellford A new mechanism to reverse the motion of steam engines, particularly of locomotives.
458. Peter Evans Donaldson. Improvements in dams, locks, and lock-gates.
459. Charles Weightman Harrison and Joseph Harrison. Improvements in protecting insulated telegraphic wires.
460. Gustave Paul de Lhuynes. Improvements in apparatus for public announcements or advertisements.
461. Thomas Henry Biddles and John William Duphrate. Improvements in machinery for the manufacture of textile and looped fabrics.
462. Jacob Tilton Slado. An improved hoisting apparatus.
463. William Harrison. Certain improvements in machinery or apparatus for sizing, and otherwise preparing cotton, wool, flax, and other warps for weaving.
454. John Gilbert and Samuel Nye. Improvements in mincing meat and other substances.
465. Joseph Cundy. Improvements in hot-air stoves.
466. Robert Burns and Richard Pritchard Willett. Certain improvements in machinery or apparatus for cutting bones.
467. John Smith. A machine for the cultivation or cleaning of land, and for digging potatoes or other roots.

Dated October 21, 1852.

468. Alexander Thomas. Certain improvements in the treatment and welding of metals by certain chemical combinations.
469. Robert Hoppen. Improvements in apparatus for mincing meat.
470. William Lukyn, the elder. A liquid draught detector, or self-measuring tube, with a union conveyance tap and its stock and time-table.
471. John Provis. Improvements in the construction of ships or vessels.
472. Joseph Rose. Improvements in locks.
473. Julian Bernard. Improvements in the production of ornamental surfaces upon leather.
474. William Weild. Improvements in looms for weaving certain descriptions of pile fabrics.
475. John Currie. Improvements in grinding wheat and other substances, and in the treatment and preparation of such substances, and the products thereof.
476. Samuel Marsh. Improvements in the manufacture of woven fabrics by means of lace machinery.
477. Henry Charles Gover. Improvements in the apparatus used in printing with colours.
478. Robert Chalker. Improvements in the manufacture of manure.
479. William Addison. Improvements in constructing and propelling vessels.
480. John Fowler. Improvements in machinery for draining land.
481. John Fowler. Improvements in laying wires for electric telegraphs.
482. John Fowler. Improvements in reaping machinery.
483. John Fowler. Improvements in machinery for sowing seed and depositing manure.

Dated October 22, 1852.

484. George Ellins. An improved method and apparatus for dressing and cleaning flax straw.

485. Jean Marie Souchon. Improvements in the manufacture and purification of gas for illumination, and certain products therefrom, and in apparatus for that purpose.
486. Julien Boilesve. An improved mode of preserving vegetable substances and animal coatings.
487. Archibald Slate. Certain improvements in the manufacture and construction of cores, and core-bars, used in the production of hollow castings in iron and other metals.
488. Juliana Martin. An improved apparatus for artificial hatching.
489. Peter Armand Le Comte de Fontaine Moreau. Improvements in apparatus for essaying silk, cotton, and other similar fibrous substances.
490. Stanislaus Hoga. Improvements in separating gold from the ore.
491. James Wilson. Improvements in printing fabrics of silk or partly of silk.

Dated October 23, 1852.

492. John Holmes. Improvements in lathes.
493. George Price. A new or improved gas stove.
494. Philip Berry. Certain improvements in machinery or apparatus for manufacturing bolts and nuts, and other similar articles in metal.
495. David Crichton. Arrangements and apparatus for producing continuous circular motion, giving a series of different velocities obtained from alternate motions applicable to looms and other machines.
496. Thomas Fothergill and Alexander Cumming Harvey. Certain improvements in the treatment of cotton wool, and in the manufacture of coloured yarns or threads therefrom.
497. Louis Napoleon Legras and William Lawrence Gilpin. Improvements in the
498. George Malcolm. Certain improvements in the process of carding or testing jute or other fibrous substances.
generation of electricity.
500. Arnold James Cooley. Improvements in the manufacture of artificial leather.
501. Louis Napoleon Legras and William Lawrence Gilpin. Improvements in treating flax, hemp, and other fibrous substances.
502. Charles William Graham. Improvements in the manufacture of bottles and jars.
503. Albert Hiscock. The application of ornamental printing to certain fabrics which have hitherto not been printed upon.
504. George Kennedy Geyelin. An improved machine for grinding pigments or other vegetable or mineral substances.
505. William Macbay. Improvements in extinguishing fire in dwellings, factories and other buildings, and in ships.
506. Robert Mudge Marchant. Improvements in the construction of bridges.
507. Felix Lieven Bauwens. Improvements in treating fatty matters prior to their being manufactured into candles and mortars, which are also applicable to oils.
508. William White. An improved fabric, suitable for ventilating hat bodies.
509. Charles Watson. Improvements in ventilation.

Dated October 25, 1852.

511. John Hunter. Improvements in electric telegraphs, and in apparatus connected therewith.
512. John James Stoll. Improvements in the manufacture of boots and shoes and similar articles, and in machinery used therein, entitled metallic-toothed, and wedged seams, and water-proof elastic indented stitches.
514. Charles Leon Desbordes. Improvements in instruments for measuring the pressure and temperature of air, steam, and other fluids.
515. Robert William Mitcheson. Improvements in anchors.
516. Arthur Wall. Improvements in the manufacture of sulphuric and other acids.
517. Joseph Florentin Anacharsis Debray. An improved stock or neckcloth.
518. William Johnson. Improvements in the manufacture of spikes or metal pins.
519. Mathew Fitzpatrick. Certain improvements in machinery or apparatus to be applied to locomotive engines and carriages for the prevention of accidents, and also in the manufacture and application of indestructible and non-rebounding cushions, to be applied to the above and for other similar purposes.

Dated October 26, 1852.

520. Claude Mamés Augustin Marion. A new kind of damper for moistening stamps and paper.
521. John Cass. Improvements in steam engines.
522. William Smith and John Smith. Certain improvements in garments and articles of dress.
523. William Clarke. Improvements in joints or connecting metals.
524. Charles Rowley. Certain improvements in nails.
525. Myer Myers and Maurice Myers. Certain improvements in pens and pen-holders.
526. James Nasmyth. An improved mode of utilising running waters.
527. Joseph Charles Frederick Baron de Kleinsorgen. An improved apparatus for indicating the variation of the magnetic needle.
529. Robert William Mitcheson. An improved safety hook.
530. Henry Page. Improvements in paper staining.

October 27, 1852.

531. George Evans. Improvements in treating peat and other carbonaceous matters.
532. John Lee Stephens. Improvements in furnaces.
533. Anthony Fothergill Bainbridge. Improvements in the manufacture of artificial flies and other bait for fish.
534. Samuel Clarke. Improvements in the manufacture of candles.
535. James Conry. Improvements in umbrellas and parasols.
536. James Crosby. Improvements in looms.
537. William Robert Bertolacci. An improved pneumatic ink and penholder.
538. Alfred Charles Hervier. An improvement in the application of centrifugal force to propelling on water.
539. Louis Napoleon Le Gras and William Lawrence Gilpin. A compound, having the properties of gutta percha.
541. Thomas Wilks Lord. Improvements in safety and other lamps.
542. Henry Carr. Certain improvements in railways.
543. John Norton. Improvements in blasting.
544. James Hadden Young. Improvements in expressing juice or fluid from the sugar cane, and from other matters.
545. Charles Benjamin Normand. Improvements in machinery for sawing wood.
546. James Nasmyth. Improvements in the mode of obtaining and applying motive power.
547. James Henry Smith. Improvements in corsets.

October 28, 1852.

548. William Thorp. Certain improvements in steam boxes, and the mode of heating press plates used in hot-pressing of silks, de laines, cobourgs, merinos, fancy goods, and other similar fabrics.
549. Bryan Donkin, the younger, and Barnard William Farey. Improvements in the machinery for measuring or marking off long lengths or continuous webs of paper or other materials into any required lengths, for the purpose of being cut or otherwise disposed of.
550. John Wormald. Improvements in machinery or apparatus for roving, spinning, and doubling cotton, wool, or other fibrous substances.
551. Henry Provost. An improved hat protector.
552. George Hattersley. A radiating hearth-plate.
553. Charles Frederick Bielefield. Improvements in billiard and bagatelle tables.
554. John Collis Browne. An invention for the relief of individuals suffering from pulmonary affections or diseases of the chest.
555. Thomas Parker Tabberer. Improvements in machinery for frame-work knitting.
556. Charles Arthur Redd. Improvements in telegraphing or communicating signals at sea and otherwise.
557. Robert Mallett. Improvements in fireproof and other buildings and structures.

October 29, 1852.

558. Henry Robert Ramsbotham and William Brown. Improvements in preparing and combing wool and other fibrous substances.
559. Charles Auguste Joubert, Léon Jacques Tricas, and Julius César Kohler. Improved busks for stays.
560. Arthur Ashpital, and John Whichcord, the younger. Certain improvements in cocks, valves, and fire-plugs.
561. James Godfrey Wilson. Improvements in signals to be used on railways, or for similar purposes, and in the apparatus connected therewith.
562. Arnold James Cooley. Improvements in woven and felted fabrics, to render the same repellent to water and damp.
563. George Bower. Improvements in gas stoves or fire-places.
564. William Bates. Improvements in apparatus for getting-up stockings and other hosiery goods.
565. William Henry Fox Talbot. Improvements in the art of engraving.
566. Louis Napoleon Le Gras, and William Lawrence Gilpin. Improvements in transmitting electric currents.
567. Richard Archibald Brooman. Improvements in violins and other similar stringed musical instruments.
568. Richard Archibald Brooman. Improvements in tackle blocks.

Dated October 30, 1852.

569. William Binns. An improved mode of constructing a draught breast-plate or collar for horses or other draught animals.
570. Martin Watts. Certain improvements in machinery or apparatus for roving or preparing cotton and other fibrous substances for spinning.
573. Edward Bird and Edward Welch. An improved cart or vehicle.
574. John Gedge. Improvements in printing presses or machines.
575. Pierre Bernardet de Lucenay. The production of photographic images by means of artificial light.
576. Bowman Fleming McCallum. A yarn drying machine.
577. John Crowther and William Teale. Improvements in obtaining motive power.
578. Edmund Adolphus Kirby. An improved adjusting couch for medical, surgical, and general purposes.
579. Alfred Vincent Newton. Improvements in machinery for cutting corn and other standing crops.
580. Jean Auguste Lebrun. Improvements in the construction of buildings and pavements, and the manufacture of the materials used therein.
581. Julian Bernard. Improvements in the manufacture of glass.
582. James Sinclair. Improvements in engines to be worked by steam, air, or water, the said improvements being also applicable to pumps.
583. Richard Archibald Brooman. Improvements in revolving fire-arms.
584. George Thomas Selby. Improvements in steam boilers.
586. George Thomas Selby. Improvements in machinery for the manufacture of tubes and pipes.
588. George Fergusson Wilson and Edward Partridge. Improvements in the instruments or apparatus used when burning candles.
589. William Dantee. Improvements in preventing incrustation in steam boilers.

Dated November 1, 1852.

590. William Petrie. Improvements in the manufacture of sulphuric acid.
591. George Evans. An improved gridiron.
592. George Dixon. An improvement in bleaching palm oil.
593. Edward Lawson. Certain improvements in machinery for preparing to be spun, hemp, flax, tow, wool, silk, cotton, and other fibrous materials.
594. Charles John Berkeley. A new or improved reflector, or new or improved reflectors, for illuminating purposes.
595. Joseph John William Watson and Thomas Slater. Improvements in galvanic batteries, and in the application of electric currents to the production of electrical illumination and of heat, and in the production of chemical products by the aforesaid improvements in galvanic batteries.
596. Joseph Dunning. Improvements in the construction of coke ovens.
597. Henry Walker. Improvements in machinery and apparatus used in cylinder printing.
598. Henry Brock Billows. Improvements in the construction of gas burners for illuminating and heating purposes.
599. Julius Smith. Certain improvements in apparatus to be used in ships and steamers for ascertaining and signalling depths at sea.
600. George Fergusson Wilson. Improvements in the manufacture and treatment of oils.
601. Julius Jeffreys. Improvements in obtaining power when steam or other vapour is used.
602. John Chubb. Improvements in locks.
603. David Thompson. Improvements in the manufacture of carpets.
604. Paul Jerrard. Certain improvements in ornamenting japanned and papier maché surfaces, as also the surfaces of varnished and polished woods.
605. George Stenson. Improvements in apparatus for separating gold from auriferous sand and earth.
606. John Jacques, the younger. Improvements in chess and draught boards.
607. Francis Daniell. Improvements in stamp heads.

Dated November 2, 1852.

608. Jerome André Drieu. Improvements in machinery for weaving and for dividing double cloth to make pile fabrics.
609. John Nicholas Marion. A new mode of rendering concrete coleseed oil.
610. William Edward Newton. Improvements in the manufacture of capsules or covers for bottles and other hollow articles.
611. Robert William Sievier. Improvements applicable to the manufacture of hats, caps, and bonnets, or other coverings for the head.
612. James Dible. Improvements in ventilating and heating ships, which improvements are also applicable to extinguishing fire on board ship.
613. Gerge Hyacinthe Ozouf. Certain improvements in working, forming, or shaping sheet metal and alloys.
614. Charles Dickson Archibald. Improvements in machinery and apparatus for crushing, grinding, and triturating refractory and other materials, and for washing and separating ores and metals from earthy and other substances.
615. Charles Dickson Archibald. Improvements in lighting and heating.
616. Louis Auguste Pouget. Improvements in lamps.
617. John Macintosh. Improvements in the manufacture of paper.
619. George Fergusson Wilson. Improvements in the preparation of metals for, and in the manufacture of, candles and night lights.
620. George Fergusson Wilson. Improvements in treating wool in the manufacture of woollen and other fabrics.
621. Bernhard Samuelson. Improvements in breaking up and tilling land.